Internal Report
DESY F41
HASYLAB 81/05
April 1981

OPTICAL PROPERTIES OF METALS II: NOBLE METALS, ALUMINUM, THE LANTHANIDES AND THE ACTINIDES, $0.1 \leq h\nu \leq 500$ eV

		Sc	(Ti	V	Cr	Mn	Fe	Co	Ni)*	Cu	Al			
		Y	(Zr	Nb	Mo		Ru	Rh	Pd)*	Ag				
		La	(Hf	Ta	W	Re	Os	Ir	Pt)*	Au				
Ce	Pr	Nd		Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
Th		U			Am									

by

J.H. Weaver, C. Krafka

D.W. Lynch and E.E. Koch

OPTICAL PROPERTIES OF METALS II: NOBLE METALS, ALUMINUM, THE LANTHANIDES AND THE ACTINIDES, 0.1 ≤ hν ≤ 500 eV

		Sc	(Ti	V	Cr	Mn	Fe	Co	Ni)*	Cu	Al	
		Y	(Zr	Nb	Mo		Ru	Rh	Pd)*	Ag		
		La	(Hf	Ta	W	Re	Os	Ir	Pt)*	Au		
Ce	Pr	Nd		Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th		U			Am							

J.H. Weaver and C. Krafka

Synchrotron Radiation Center, University of Wisconsin†
Stoughton, Wisconsin 53589 USA

D.W. Lynch

Department of Physics, Iowa State University and Ames Laboratory USDOE†
Ames, Iowa 50011 USA

E.E. Koch

Hamburger Synchrotronstrahlungslabor HASYLAB, DESY
Hamburg, West Germany

* See Volume I

† Work supported in part by NSF DMR7821080 and DOE-OBES-W7405-Eng-82

Part I and Part II will be published by Fachinformationszentrum Energie, Physik, Mathematik GmbH Karlsruhe

ACKNOWLEDGEMENTS

The authors are grateful for the encouragement of colleagues and the excellent support of their home laboratories. The optical measurements shown herein associated with two of the authors (Weaver and Lynch) often reflect collaboration with C.G. Olson of the Ames Laboratory. In our own original optical studies, we profited from the fine support of the Ames Laboratory, USDOE, and the Synchrotron Radiation Center, University of Wisconsin-Madison. We are grateful to M.J. Arttus for her dedication in preparing this manuscript; to B. Kaufner and W. Knaut for their skillful drawings of the many figures; to K. Weaver for encouragement; to colleagues who provided the results of their optical studies, published and unpublished; and to D.J. Peterman for computer assistance.

TABLE OF CONTENTS

Page

Vorwort/Preface ii

Acknowledgements iii

List of Tables 1

List of Figures 2

List of Recommended Data 7

1. Introduction 8

1.1 General Comments 8
1.2 Definitions 11
1.3 Methods of Measurements and Errors 19
1.4 Use and Misuse of the Data 25
1.5 References 28

2. Optical Properties of the Noble Metals and Al 32

Cu 32
Ag 43
Au 54
Al 70

3. Optical Properties of the Lanthanides 87

Sc 87
Y 96
La 112
Ce 117
Pr 120
Nd 125
Sm 131
Eu 136
Gd 143
Tb 155
Dy 164
Ho 175
Er 184
Tm 193
Yb 202
Lu 207

4. Optical Properties of the Actinides 219

Th 219
U 227
Am 236

5. Bibliography 239

LIST OF TABLES

Page

Table 1. List of Abbreviations 31

Table 2. Cu - Summary of Experimental Studies 32

Table 3. Ag - Summary of Experimental Studies 43

Table 4. Au - Summary of Experimental Studies 54

Table 5. Al - Summary of Experimental Studies 70

Table 6. Sc - Summary of Experimental Studies 87

Table 7. Y - Summary of Experimental Studies 96

Table 8. La - Summary of Experimental Studies 112

Table 9. Ce - Summary of Experimental Studies 117

Table 10. Pr - Summary of Experimental Studies 120

Table 11. Nd - Summary of Experimental Studies 125

Table 12. Sm - Summary of Experimental Studies 131

Table 13. Eu - Summary of Experimental Studies 136

Table 14. Gd - Summary of Experimental Studies 143

Table 15. Tb - Summary of Experimental Studies 155

Table 16. Dy - Summary of Experimental Studies 164

Table 17. Ho - Summary of Experimental Studies 175

Table 18. Er - Summary of Experimental Studies 184

Table 19. Tm - Summary of Experimental Studies 193

Table 20. Yb - Summary of Experimental Studies 202

Table 21. Lu - Summary of Experimental Studies 207

Table 22. Th - Summary of Experimental Studies 219

Table 23. U - Summary of Experimental Studies 227

Table 24. Am - Summary of Experimental Studies 236

LIST OF FIGURES

Page

Fig. 1 Sketch of the reflectance of a free electron gas, its dielectric function, and its loss function..... 14

Fig. 2 Survey of available data on Cu..... 35

Fig. 3 Reflectivity of Cu..... 36

Fig. 4 ϵ_1 of Cu..... 38

Fig. 5 ϵ_2 of Cu..... 39

Fig. 6 Absorption coefficient of Cu..... 40

Fig. 7 Survey of available data on Ag..... 46

Fig. 8 Reflectivity of Ag..... 48

Fig. 9 ϵ_1 of Ag..... 49

Fig. 10 ϵ_2 of Ag..... 50

Fig. 11 Absorption coefficient of Ag..... 51

Fig. 12 Survey of available data on Au..... 58

Fig. 13 Reflectivity of Au..... 60

Fig. 14 ϵ_1 of Au..... 61

Fig. 15 ϵ_2 of Au..... 62

Fig. 16 Absorption coefficient of Au..... 63

Fig. 17 Survey of available data on Al..... 73

Fig. 18 Reflectivity of Al..... 75

Fig. 19 ϵ_1 of Al..... 76

Fig. 20 ϵ_2 of Al..... 77

Fig. 21 Absorption coefficient of Al..... 78

Fig. 22 Survey of available data on Sc..... 88

Fig. 23 Reflectivity of Sc..... 89

Fig. 24 ϵ_1 of Sc..... 90

Fig. 25 ϵ_2 of Sc..... 91

LIST OF FIGURES (continued)

Page

Fig. 26 Survey of available data on Y..... 97

Fig. 27 Reflectivity of Y..... 98

Fig. 28 ϵ_1 of Y..... 99

Fig. 29 ϵ_2 of Y..... 100

Fig. 30 Absorption coefficient of Y..... 101

Fig. 31 Survey of available data on La..... 113

Fig. 32 Reflectivity of La..... 114

Fig. 33 Optical conductivity of La..... 115

Fig. 34 Absorption coefficient of La..... 116

Fig. 35 Survey of available data on Ce..... 118

Fig. 36 Absorption coefficient of Ce..... 119

Fig. 37 Survey of available data on Pr..... 121

Fig. 38 Reflectivity of Pr..... 122

Fig. 39 Optical conductivity of Pr..... 123

Fig. 40 Absorption coefficient of Pr..... 124

Fig. 41 Survey of available data on Nd..... 126

Fig. 42 Reflectivity of Nd..... 127

Fig. 43 Optical conductivity of Nd..... 128

Fig. 44 Absorption coefficient of Nd for $105 \leq h\nu \leq 600$ eV..... 129

Fig. 45 Absorption coefficient of Nd for $110 \leq h\nu \leq 170$ eV..... 130

Fig. 46 Survey of available data on Sm..... 132

Fig. 47 Reflectivity of Sm..... 133

Fig. 48 Optical conductivity of Sm..... 134

Fig. 49 Absorption coefficient of Sm..... 135

LIST OF FIGURES (continued)

Page

Fig. 50 Survey of available data on Eu..... 137
Fig. 51 Reflectivity of Eu..... 138
Fig. 52 ϵ_1 or Eu..... 139
Fig. 53 ϵ_2 of Eu..... 140
Fig. 54 Optical conductivity of Eu..... 141
Fig. 55 Absorption coefficient of Eu..... 142
Fig. 56 Survey of available data on Gd..... 145
Fig. 57 Reflectivity of Gd..... 146
Fig. 58 Optical conductivity of polycrystalline Gd..... 147
Fig. 59 Optical conductivity of single crystal Gd..... 148
Fig. 60 Absorption coefficient of Gd for $0 \leq h\nu \leq 60$ eV..... 149
Fig. 61 Absorption coefficient of Gd for $135 \leq h\nu \leq 600$ eV..... 150
Fig. 62 Survey of available data on Tb..... 156
Fig. 63 Reflectivity of Tb..... 157
Fig. 64 Optical conductivity of Tb..... 158
Fig. 65 Absorption coefficient of Tb..... 159
Fig. 66 Survey of available data on Dy..... 166
Fig. 67 Reflectivity of Dy..... 167
Fig. 68 Optical conductivity of Dy..... 168
Fig. 69 Absorption coefficient of Dy for $5 \leq h\nu \leq 50$ eV..... 169
Fig. 70 Absorption coefficient of Dy for $140 \leq h\nu \leq 600$ eV..... 170
Fig. 71 Survey of available data on Ho..... 176
Fig. 72 Reflectivity of Ho..... 177
Fig. 73 Optical conductivity of Ho..... 178
Fig. 74 Absorption coefficient of Ho..... 179

LIST OF FIGURES (continued)

Page

Fig. 75 Survey of available data on Er..... 185
Fig. 76 Reflectivity of Er..... 186
Fig. 77 Optical conductivity of Er..... 187
Fig. 78 Absorption coefficient of Er..... 188
Fig. 79 Survey of available data on Tm..... 194
Fig. 80 Reflectivity of Tm..... 195
Fig. 81 Optical conductivity of Tm..... 196
Fig. 82 Absorption coefficient of Tm..... 197
Fig. 83 Survey of available data on Yb..... 203
Fig. 84 Reflectivity of Yb..... 204
Fig. 85 Optical conductivity of Yb..... 205
Fig. 86 Absorption coefficient of Yb..... 206
Fig. 87 Survey of available data on Lu..... 208
Fig. 88 Reflectivity of Lu..... 209
Fig. 89 Optical conductivity of Lu..... 210
Fig. 90 Absorption coefficient of Lu..... 211
Fig. 91 Summary of absorption coefficient on La-Yb..... 216
Fig. 92 Summary of the optical absorptivity ($A = 1-R$ where R is the reflectivity) for the heavy rare earths..... 217
Fig. 93 Summary of the optical conductivity for the heavy rare earths..... 218
Fig. 94 Survey of available data on Th..... 220
Fig. 95 Reflectivity of Th..... 221
Fig. 96 Optical conductivity of Th..... 222
Fig. 97 Absorption coefficient of Th..... 223

LIST OF FIGURES (continued)

Page

Fig. 98 Survey of available data on α-U..... 228

Fig. 99 Reflectivity of α-U..... 229

Fig. 100 Optical conductivity of α-U..... 230

Fig. 101 Absorption coefficient of α-U..... 231

Fig. 102 Survey of available data on Am..... 237

Fig. 103 Reflectivity of Am..... 238

LIST OF RECOMMENDED DATA

Page

1. Cu..... 41

2. Ag..... 52

3. Au..... 64

4. Al..... 79

5. Sc..... 92

6. Y..... 102

7. Gd..... 151

8. Tb..... 160

9. Dy..... 171

10. Ho..... 180

11. Er..... 189

12. Tm..... 198

13. Lu..... 212

14. Th..... 224

15. α-U..... 232

INTRODUCTION

We have collected in this volume data on the optical properties of the elemental noble metals, aluminum, the lanthanides including Sc and Y, and the actinides. A companion volume (Vol. I) considered the optical properties of the elemental transition metals Ti-Ni, Zr-Pd, and Hf-Pt. In this way we have gathered together for easy reference the optical properties of most of the elemental metals as they are known today, 1980.

In this data compilation we present tables summarizing the work that has been done for each element (techniques, sample preparation, spectral range, etc.). Figures for each element display the most frequently used optical quantities, i.e. the normal incidence reflectance or reflectivity, the real and imaginary parts of the frequency-dependent dielectric function or the optical conductivity, and the absorption coefficient. Tables of these quantities and the loss function are also given for each element.

This data compilation covers the wavelength range 25 Å $\leq \lambda \leq$ 25 μm or the photon energy range ~0.05 $\leq h\nu \leq$ 500 eV [$h\nu$(eV) = 12398/λ (Å)]. Most of the published data fall between ~1 eV and ~6 eV, in the range where photomultiplier detectors and conventional laboratory sources are available. In the vacuum ultraviolet for ~6 $\leq h\nu \leq$ 30 eV, synchrotron radiation sources, rare gas continua, and discrete line sources have been used to measure the reflectance at near normal incidence for the noble metals and aluminum but for few of the other metals discussed here. For photon energies of

~30-200 eV the absorption coefficient has been measured with synchrotron radiation for most of the metals but rarely at higher energy. Unfortunately, we have found that there is not a complete set of data for most of the metals throughout the entire range. Data for wavelengths shorter than about 25 Å are quite sparse because of the difficulty of obtaining monochromatic radiation, particularly between 1 and 3 keV. Monochromator development programs now underway at many synchrotron radiation facilities around the world should improve the situation within the next few years.

The comparative tables and figures which describe the available data point out regions where reliable data are not available or where the present data are still insufficient or ambiguous. In many cases when we seek to provide a set of "most reliable" optical data, we have chosen to use our own data, accumulated for many of these metals over the last ten years. The reader can readily compare those tabular results to the rest of the literature through perusal of the figures. For the heavy lanthanide metals and Sc and Y, we tabulate our data for both polarizations of the electric field vector $\vec{E}$ relative to the crystallographic $\hat{c}$-axis of the hcp lattice. For the lighter lanthanides we include no tabular results. Before using our tables, the reader should consult the Methods of Measurements and Errors section and that devoted to The Use and Misuse.

The data have been obtained from a number of sources. To supplement the references collected by the authors over the years, we have searched via computer the abstracts appearing in the Physics Abstracts and Chemistry Abstracts, the former from 1969 to present and the latter from 1970 to present. In addition we have solicited unpublished data from colleagues. We have omitted much of the data obtained in the 1950's and essentially

all data obtained before 1950. We have generally excluded nonspectral optical data, e.g. values of the complex refractive index obtained ellipsometrically at the wavelengths of one or several spectral lines, and emissivity measurements at one wavelength. It is inevitable that we have overlooked some data or reference that we would like to have included. For such omissions we apologize.

The compilation has a large number of applications. For example, reliable optical constants are needed to design multiple-layer films for application in solar-energy-systems or reflecting opitcal elements. The data can be used to obtain spectral emissivities for measurements of the temperatures of hot transition metals. Of course, it can be used for a fundamental comparison between experimental optical properties and those calculated from first principles.

We begin with several definitions, then briefly discuss methods of measurement and the associated errors of each. Finally, before presenting the data in tabular and pictorial form, we offer several caveats about the use of the data.

DEFINITIONS

In a macroscopic view, the propagation of electromagnetic waves in an absorbing medium is governed by a frequency-dependent conductivity, $\sigma(\omega)$, and a frequency-dependent dielectric constant, $\varepsilon(\omega)$. The $\varepsilon(\omega)$-function are combined into a frequency-dependent complex conductivity, $\tilde{\sigma} = \sigma_1 + i\sigma_2$, or a frequency-dependent complex dielectric function $\tilde{\varepsilon} = \varepsilon_1 + i\varepsilon_2$, with

$$\tilde{\varepsilon}(\omega) = 1 + 4\pi i\tilde{\sigma}(\omega)/\omega \qquad (1)$$

and $\varepsilon_1 = \varepsilon$ and $\sigma_1 = \sigma$. Note that a metal, with its finite conductivity at $\omega = 0$, has $\varepsilon_2(\omega) \to \infty$ as $\omega \to 0$, but this causes no problems in the wave equation.*

For non-cubic materials, $\tilde{\sigma}$ and $\tilde{\varepsilon}$ will be tensors[7,8], but for all elemental metals which have been measured this tensor is diagonal in the crystallographic axis system, and there are no more than three independent components. One should be aware, however, that evaporated films of non-cubic metals may not always have isotropic optical properties, for there often is a preferred texture, with close-packed planes preferred. In the ensuing discussion we assume, for simplicity, an optically isotropic metal, either a cubic crystal or randomly-oriented grains in a polycrystalline film.

---

* The time-dependent Maxwell's equations are Fourier analyzed. In complex notation the time dependence of all fields is then either $\exp(i\omega t)$ or $\exp(-i\omega t)$. Either may be used and the resultant real parts of the fields, the measurables, are the same. The choice of sign does, however, affect the signs of the imaginary parts of the optical functions. We have used $\exp(-i\omega t)$ which leads to the positive sign on the imaginary parts of the complex quantities above. This choice is more consistent with the microscopic interpretation of optical properties based on quantum mechanics. The other choice of sign also is widely used, however.

Optical studies describe the response of matter to an applied electromagnetic field at optical frequencies (~10^{16} Hz). As discussed above, this is done through the frequency-dependent complex dielectric function, $\tilde{\varepsilon}(\omega) = \varepsilon_1 + i\varepsilon_2$ or, equivalently, the complex conductivity, $\tilde{\sigma}(\omega) = \sigma_1 + i\sigma_2$, which are used with Maxwell's equations, but which are descriptions of the material being studied. These are fundamental quantities, and can be calculated quantum mechanically from microscopic models of the solid. Either represents the elementary excitation spectrum, i.e., ε_2 (interband) or σ_1 (interband) provides a measure of interband absorption. ε_2 (interband) can be written as

$$\omega^2\varepsilon_2 = \frac{e^2\hbar^2}{3\pi m^2} \sum_{if} \int_0^\infty d^3\bar{k} |\langle f|p|i\rangle|^2 \, \delta(E_f(\bar{k}) - E_i(\bar{k}) - \hbar\omega), \qquad (2)$$

where the electric dipole approximation has been used for the electron-photon interaction Hamiltonian, $|i\rangle$ and $|f\rangle$ are the initial (occupied) and final (empty) states, and $\bar{k}$, the electron wave vector, has been conserved through direct transitions.

A complete calculation of ε_2 from first principles is difficult, but can be simplified by assuming that matrix elements are independent of $\bar{k}$, i.e. are constant throughout the Brillouin zone. Then

$$\omega^2\varepsilon_2 \propto \sum_{if} \int_0^\infty d^3k \, \delta(E_f(\bar{k}) - E_i(\bar{k}) - \hbar\omega), \qquad (3)$$

which is termed the joint density of states (JDOS). The JDOS reflects the shape of the electronic energy bands, but obscures any information regarding transition probability variation.

Evaluations of equations (2) or (3) for the transition metals have shown that structures in the experimental ε_2 can arise from extended volumes of k-space, and the importance of critical points is diminished in transition metals. Further, it has been shown that volumes of k space which are removed from high-symmetry lines can be the source of interband structures.

The dielectric function for the transition metals also includes contributions from intraband absorption. The free-carrier or intraband (or free-electron or Drude) absorption is described by

$$\tilde{\varepsilon}(\omega) = 1 - \frac{\omega_p^2}{\omega(\omega + i/\tau)} \qquad (4)$$

where ω_p is the free-electron plasma frequency and τ is the electronic relaxation time. The plasma frequency is defined by $\omega_p^2 = 4\pi Ne^2/m$, where N is the number of electrons of mass m per unit volume. For a free-electron gas with $\omega\tau >> 1$, the absorptivity reduces to $A = 2/\omega_p\tau$ which is small. In figure 1, the free electron dielectric function is shown qualitatively. At low energy, ε_2 is large and positive while ε_1 is large and negative. Both approach zero with increasing photon energy; ε_1 ultimately crosses zero at the plasma frequency and approaches unity at infinite frequency. In an experimental spectrum of the dielectric function for a real metal, the deviation from this simple behavior can be taken as an indication of interband absorption; see Fig. 1 for sketches of free carrier behavior.

For transition metals, where the d bands intersect the Fermi level, interband absorption begins at arbitrarily low energy, and it is impossible to separate the interband and intraband contributions completely. Nevertheless, it may be possible to fit the measured spectrum with a Drude-like spectrum over a limited energy range. The Drude parameters obtained in that way should not be taken too seriously. Nevertheless, they are often useful for separating approximately the low-energy interband and intraband contributions to $\tilde{\varepsilon}(\omega)$ facilitating comparison of theory with experiment.

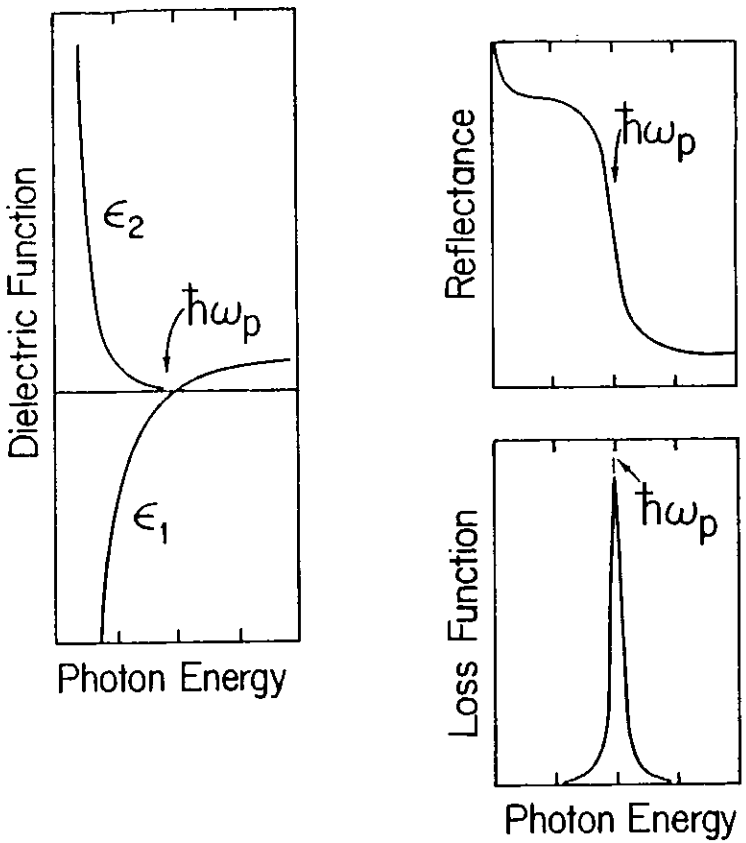

Fig. 1 Sketch of the reflectance of a free electron gas, its dielectric function, and its loss function.

The real and imaginary parts of the dielectric function are not completely independent. They are related in an integral-transform fashion by the so-called Kramers-Kronig or dispersion integrals:[2-5]

$$\epsilon_1(\omega) - 1 = \pi^{-1} \, P \int_0^\infty \frac{\epsilon_2(\omega') - \frac{4\omega\sigma(o)}{\omega'}}{\omega'^2 - \omega^2} \, \omega' d\omega' \tag{5}$$

$$\epsilon_2(\omega) - \frac{4\pi\sigma(o)}{\omega} = \frac{-2\omega}{\pi} \, P \int_0^\infty \frac{\epsilon_1(\omega') - 1}{\omega'^2 - \omega^2} \, d\omega' \tag{6}$$

where P denotes principal value. If a set of optical data such as $\epsilon_1(\omega)$ and $\epsilon_2(\omega)$ is self-consistent, it must satisfy the above relations, when suitable extrapolations to zero and infinity are appended to the data measured over some finite spectral range.

By letting $\omega \to \infty$, a limit in which we expect the electrons in the solid to behave as free electrons, we obtain the sum rule[2,5]

$$\int_0^\infty \omega\epsilon_2(\omega) d\omega = 2\pi^2 \, \frac{Ne^2}{m} = \frac{\pi}{2} \omega_p^2 \tag{7}$$

which forms a very useful test of the data. This is equivalent to the f-sum rule of atomic physics. It states that the integral of ϵ_2 weighted by ω is proportional to N, the number density of electrons in the sample. By integrating to a finite upper limit, partial sum rules are obtained, but their use is somewhat restricted by assumptions necessary for their use.

There are several other sum rules[2,3] that are useful for testing data for consistency. These are

$$\int_0^\infty [\epsilon_1(\omega) - 1] \, d\omega = -2\pi^2\sigma(o), \tag{8}$$

which relates the real part of the dielectric function to the d.c. conductivity, and

$$\int_0^\infty [n(\omega) - 1]d\omega = 0 \ , \qquad (9)$$

which states that the average value of the refractive index is unity. These, and others[9-12], have been applied to optical data for aluminum and, to date, there are departures from self-consistency even when the best available data are used[13].

The boundary conditions on the electric and magnetic fields, implicit in Maxwell's equations[1-6], give values for the reflected and transmitted fields in terms of the dielectric function, $\tilde{\varepsilon}$, the angle of incidence, ϕ, and the state of polarization, s or p. If $\tilde{r}$ is the ratio of reflected electric field to incident electric field at a vacuum-solid interface, then[6]

$$\tilde{r} = \frac{\tilde{E}_r}{\tilde{E}_i} = (\tilde{g} - 1)/(\tilde{g} + 1) \qquad (10)$$

with $\tilde{g} = \sqrt{\tilde{\varepsilon}} \cos \phi'$ for s-polarization

and $\tilde{g} = \cos \phi'/\sqrt{\tilde{\varepsilon}}$ for p-polarization,

in which $\sqrt{\tilde{\varepsilon}} \sin \phi' = \sin \phi$. The phase shift upon reflection, θ, is included in $\tilde{r}$ as $\tilde{r} = re^{i\theta}$. At this point it may be useful to introduce the complex index of refraction, defined* as

$$\tilde{N} = n + ik = \sqrt{\tilde{\varepsilon}} \ . \qquad (11)$$

Then $\varepsilon_1 = n^2 - k^2$ and $2n^2 = (+\varepsilon_1 + \sqrt{\varepsilon_1^2 + \varepsilon_2^2})$

$\varepsilon_2 = 2nk$ $\qquad 2k^2 = (-\varepsilon_1 + \sqrt{\varepsilon_1^2 + \varepsilon_2^2})$

---

* $\tilde{N}$ is sometimes written as $n(1 + iK)$.

If $\phi \to 0$ then the reflectance at normal incidence becomes

$$R = |\tilde{r}|^2 = \frac{(n-1)^2 + k^2}{(n+1)^2 + k^2} \ . \qquad (12)$$

In any case, the measured reflectance is

$$R = |\tilde{r}|^2 \ . \qquad (13)$$

The absorption coefficient μ is

$$\mu = 4\pi k/\lambda \qquad (14)$$

where λ is the wavelength in vacuum and $\mu dx = -dI/I$ is the fractional loss of flux in distance dx, leading to the decay of the photon flux in the material as $\exp(-\mu x)$.

One can also study the optical properties of a solid with electrons rather than photons. The probability that a fast electron loses energy E in traversing a thin film of material with dielectric function $\tilde{\varepsilon}(E)$ is proportional to[14-16]

$$\mathrm{Im}(-1/\tilde{\varepsilon}) = \varepsilon_2/(\varepsilon_1^2 + \varepsilon_2^2) \qquad (12)$$

By making suitable corrections to the measured intensity of the transmitted electron beam and by the use of a dispersion integral, it is possible to determine $\tilde{\varepsilon}(E)$. (There are additional corrections to be made for surface effects, for Čerenkov radiation, and for cases in which the incident electron is not sufficiently energetic.)

If the photon energy becomes high, larger than ~50 eV depending on the material, the above expressions simplify to

$$n = 1 - \delta \qquad (13)$$

with $k \ll 1$ and $\delta \ll 1$. Then

$$\varepsilon_1 = n^2 - k^2 \approx 1, \qquad (14)$$

$$R = \frac{(n-1)^2 + k^2}{(n+1)^2 + k^2} \approx \frac{\delta^2 + k^2}{4 - 2\delta} \ll 1 \ ,$$

$$\mathrm{Im}(-1/\tilde{\varepsilon}) \approx \varepsilon_2 \ .$$

A useful optical quantity in the visible and infrared is the spectral emissivity, $e(\omega)$, the fraction of blackbody radiation with a particular polarization emitted into a differential solid angle by the sample surface[17]. For an opaque sample with a flat surface this is equal to the absorptance, $A = 1 - R$, with the foregoing expressions giving R, the reflectance. (This is Kirchhoff's law.) The spectral hemispherical emittance is the sum of the integrals of the above emittance over 2π steradians for each polarization. The total hemispherical emittance at temperature T is the integral of the latter over the blackbody spectrum, divided by the blackbody spectral integral, both at temperature T. The hemispherical spectral emittance can be put into closed form as[18]

$$\sum_{pol} \frac{1}{\pi} \int_{hemis} e_{pol}(\omega,\alpha,\beta) \cos\alpha d\Omega = 4n - 4n^2 \ln\left(\frac{1 + 2n + n^2 + k^2}{n^2 + k^2}\right) \quad (18)$$

$$+ \frac{4n(n^2 - k^2)}{k} \tan^{-1}\left(\frac{k}{n + n^2 + k^2}\right)$$

$$+ \frac{4n}{n^2 + k^2} - \frac{4n^2}{(n^2 + k^2)^2} \ln(1 + 2n + n^2 + k^2)$$

$$+ \frac{4n(n^2 - k^2)}{k(n^2 + k^2)} \tan^{-1}\left(\frac{k}{1 + n}\right) .$$

where $d\Omega = \sin\alpha d\alpha d\beta$. α and β are the polar and azimuthal angles ($\alpha = \phi$, the angle of incidence used previously, and often there is no β-dependence). [The factor of π represents $\int_{hemis} 1 \cos\alpha d\Omega$, the spectral hemispherical emissivity of a blackbody of unit spectral emissivity, i.e. the normalizing factor.]

METHODS AND MEASUREMENT AND ERRORS

In general, any measured quantity can be expressed in terms of ϵ_1 and ϵ_2 or n and k, but, since both real and imaginary parts of the dielectric function appear in the expression, two measurements are needed at each frequency to obtain two equations from which $\tilde{\epsilon}$ or $\tilde{N}$ can be found. There are four general categories of measurement: (1) photometric, (2) photometric with dispersion integrals, (3) ellipsometric, and (4) electron energy loss with dispersion integrals. Space limitations preclude a detailed discussion of each, but a few general statements seem to be in order[19].

(1) Photometric[20-40]. Two quantities involving the reflected photon flux, or possibly the flux transmitted through thin films, are measured. Examples are the reflectance of p-polarized light at two angles of incidence; the angle at which the p-polarized reflectance is a minimum and the value of R_p there; and even R_p and $dR_p/d\phi$ at some ϕ. More than two measurements may be made, e.g. R_p vs. ϕ, and the data fitted to $R_p(\phi)$. Experimental errors may involve all of the following: nonlinearity of the detector, nonhomogeneity and polarization sensitivity of the detector, failure to collect all reflected flux, and the use of different surface areas if two angles of incidence are used. These measurement errors may be very difficult to estimate. If an estimate can be made, it is relatively easy to determine how the errors will propagate to produce errors in n and k. Such an error analysis can be used to select the best, or at least better, quantities to measure for a sample of assumed optical properties. In general there is not a universal best method. The sample, its properties, and the wavelength region make some methods better than others.

(2) Photometric with dispersion integrals[2,5,41-55]. Here one measures R at fixed ϕ (often near-normal incidence) and fixed polarization over as wide a frequncy range as possible. The real and imaginary parts of the reflection coefficient $\tilde{r} = re^{i\theta}$ or of

$$\ln r = \ln(re^{i\theta}) = \ln(\sqrt{R}e^{i\theta}) = \tfrac{1}{2}\ln R + i\theta \qquad (13)$$

obey a dispersion or Kramers-Kronig integral. With suitable extrapolations beyond the range of the data, one can obtain $\theta(\omega)$ from $R(\omega)$. Errors in the measured reflectance then appear in the derived dielectric function as with other methods, but there are additional errors associated with the extrapolations. In general, the extrapolation errors affect the magnitude of ε_1 and ε_2 much more than they affect the positions and shapes of spectral structures. We have found, for example, that in Mo our dielectric function results obtained using dispersion integrals and measurements of $R(\omega)$ for 0.1-30 eV agree with $\tilde{\varepsilon}$ data obtained by photometric and ellipsometric methods to within 10%, while an error analysis yields an estimate of possible errors of up to 50%.

The availability of some transmission or electron energy loss data above 30 eV reduces the expected extrapolation errors, as does requiring the extrapolation to give reasonable values for the sum rule on ε_2 in the region of the extrapolation. A "variation" of the Kramers-Kronig method is to fit a reflectance spectrum with a series of oscillators, whose dielectric function then is represented by that of the sum of oscillators[56-57].

(3) Ellipsometric[58]. The ratio of reflected electric fields for p- and s-polarization is

$$\tilde{r}_p/\tilde{r}_s = (r_p/r_s)e^{i(\theta_p-\theta_s)} = \rho e^{i\Delta} \qquad (20)$$

The change in the state of polarization of reflected light can be measured,

giving ρ and Δ, from which $\tilde{\varepsilon}$ can be found. Ellipsometry has been carried out on metals since the time of Drude, but only relatively recently have data been taken at more than a few discrete wavelengths. Automatic ellipsometers now exist, often yielding $\tilde{\varepsilon}$ vs. ω directly with an on-line computer. Errors in ellipsometry can be different from those in photometry. The alignment of the polarizing elements is very important and can lead to errors. Ellipsometry is rarely carried out at energies above 6 eV for lack of effective polarizing elements.

(4) Electron energy loss[14-16]. As mentioned previously, energy analysis of energetic electrons passing through thin films can give $\mathrm{Im}(-1/\tilde{\varepsilon})$. This quantity is related to $\mathrm{Re}(-1/\tilde{\varepsilon})$ by a dispersion integral. Thus with suitable extrapolations, and possibly with a normalization factor based on other data, $\tilde{\varepsilon}$ can be obtained. In the measurement of electron energy loss spectra one must subtract out not only the surface losses but also multiple losses. In fact, the response of the solid to fast electrons is governed by the longitudinal dielectric function while the response to photons is governed by the transverse function. To date, experimental differences between them are negligible for purposes of this document.

All these methods are difficult to apply to metals in the infrared because $R \to 1$ for all ϕ and $\rho \to 1$. For photometric methods one can measure the absorptance, $A = 1 - R$, in methods (2) or use large angles of incidence in methods (1). In ellipsometry one can also use large angles of incidence and multiple (m) reflections to obtain $\rho^m \exp(i m\Delta)$. Finally, electron energy loss measurements usually do not have sufficient resolution to be used for metals in the infrared, i.e. $h\nu \lesssim 1$ eV, since the zero-loss spectrum may have a width of up to 0.5 eV.

Above ~30 eV the reflectance of all materials quickly falls to values below 0.01 except at large angles of incidence. The primary methods of

determining $\tilde{\varepsilon}(\omega)$ then consist of fitting R vs. ϕ for large values of ϕ, transmission measurements which give μ, or electron energy loss measurements which then require significant corrections for multiple scattering. The latter two require the use of dispersion integrals to get real and imaginary parts of $\tilde{\varepsilon}$. New types of errors arise, such as pinholes in thin-film samples, increased scattering from surface roughness as the wavelength decreases, and incompletely collimated radiation.

In all cases the most important kinds of error have not yet been mentioned. All methods make use of the Fresnel relations, derived for a flat smooth interface between two media. (This is so for the electron energy loss measurements, too, for the surface corrections rely on a description of the interface between the sample and vacuum.) Surface roughness, oxide films, and surface stresses all cause errors because the actual sample departs from the ideal strain-free material with a smooth, abrupt vacuum interface. The errors which can arise from these departures from ideality are different for each type of measurement. A rough surface, for example, will make the measured reflectance too low if any scattered radiation fails to reach the detector[59-63]. A new structure, typically a reflectance dip, may appear in the reflectance if non-radiative surface plasmons are excited at the rough surface. Ellipsometric methods are less sensitive to roughness, but only insofar as the scattered radiation is not preferentially of one polarization. A transparent oxide will lower the measured reflectance, but in the infrared such an effect is negligibly small for a metal, while submonolayer coverages of transparent oxides can be measured ellipsometrically, causing significant error if unsuspected. In the ultraviolet, oxides are strongly absorbing and cause significant errors in all types of measurement, but those sampling the bulk more than the surface, e.g. electron energy loss measurements, are less sensitive to oxides.

In order to obtain the dielectric function of a metal a strain-free, clean, flat crystalline surface is needed. In principle, the surface should be cleaned in situ, with cleanliness verified by Auger spectroscopy, and checked for crystallinity, and perhaps strain, by LEED or high-energy electron diffraction (RHEED). This must be done in ultra high vacuum to insure subsequent surface cleanliness. Only then should the optical properties be measured. Unfortunately, such studies have not been performed for most metals in even limited spectral ranges. Moreover, in data taken just at one or at a few fixed wavelengths on truly clean surfaces, evaluations of surface roughness have not been made. Most surface cleaning techniques e.g., Ar^+ bombardment followed by an anneal, can lead to roughened surfaces. Certainly the older techniques of cleaning by Ar^+ glow-discharge sputtering creates rough surfaces. One may have to choose between a rough, atomically clean surface and a smooth "dirty" one with a few monolayers of oxide, although in some cases a compromise may be reached. A compromise often used has been to electropolish the samples. This leaves a smooth, strain-free surface, but one with an overlayer of oxide, often containing Cl as well if perchloric acid, $H_2C\ell O_3$, is used as the electrolyte[64]. Such treatment causes little error in the infrared reflectance, but above about 6 eV the 2p electrons of oxygen absorb and cause errors. Of course the amount of error varies from sample to sample because of the oxidation processes itself; the oxidation rate also varies for different crystalline faces of a single crystal.

Thin films may be evaporated onto flat substrates, but they are inherently strained, polycrystalline samples. Strain will broaden structure in the optical spectra and the polycrystalline character may introduce special effects due to grain boundaries or voids. Annealing of the film

during deposition (hot substrate) or afterward will reduce the strain but at the expense of surface roughness. Recently it was shown that many conflicting spectra obtained on thin films of Au could be reconciled by assuming different degrees of porosity in the films, up to 10% maximum. In general, such voids lower the magnitudes of ε_1 and ε_2, an effect which can be viewed in zero order as an averaging in the dielectric function of the film with that of the voids, approximated by vacuum[65]. The spectra of many films measured over the years have agreed in shape but not in magnitude. In another view of grain boundaries in films the infrared energy dependence of $\tilde{\varepsilon}(\omega)$ has been interpreted with a two-medium model in which the grain boundary material has a lower electron density and a higher electron scattering (damping) rate[66,67].

For purposes of calculating mirror or interference filter performance, it may be desirable to use data taken on films, voids and all, in order to model better the performance of samples which will, in fact, be vapor deposited films. For this purpose, the tabular data reported in this volume are less suitable than some of the data we have shown in our comparison figures since the tabular data were measured with bulk samples. Furthermore, for some of the hcp metals we present tabular data for oriented single crystals with $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$ to display the optical anisotropy of the material. In principle, for a polycrystalline film with randomly-oriented grains, $\tilde{\varepsilon}(\omega) = 1/3\ \tilde{\varepsilon}_{\parallel}(\omega) + 2/3\ \tilde{\varepsilon}_{\perp}(\omega)$, but in practice the film may grow preferentially with basal plane orientation along the surface ($\hat{c}$ perpendicular to the surface).

USE AND MISUSE OF THE DATA

The data presented in this document represent our assessment of the literature. Some idea of the discrepancies between the data presented and other data is also given. A glance at some of the data we do not present but list only by reference will show that there can be extremely large discrepancies, not only in the magnitudes of $\tilde{\varepsilon}$ and $\tilde{\sigma}$ but even in the occurrence and non-occurrence of spectral features. We believe that the data tabulated are good to within ±10% in most cases (except near places where ε_1 crosses zero, for which a relative error is meaningless). The potential user should keep this 10% figure in mind for critical applications. Exceptions can be identified by examination of the figures.

The data are intended to represent the optical properties of pure, flat, strain-free, oxide-free samples. Effects of overlayers can be calculated in a straightforward manner. Departures from flatness are another matter. Slight surface roughness can be handled but in extreme cases, such as gold black or dendritic tungsten surfaces, the optical properties of the sample do not resemble those of the metal at all, purely for morphological reasons. The data could, however, be used to model such materials and cermets unless the particle size becomes too small.

We should also mention that the data are appropriate only for the normal room temperature or liquid helium temperature phase of the material. The data for fcc Ni are not at all close to those for amorphous Ni (not given), nor can the data for bcc Fe be used for the high temperature fcc phase of that metal. The effects of magnetic ordering are less extreme, but are sometimes important. For example, the data for Cr taken at 4.2 K show a small peak near 0.1 eV which is a result of the antiferromagnetic

ordering. As the temperature increases, this peak weakens and broadens and is very difficult to see at room temperature, even though Cr is still antiferromagnetic.

The functions $\tilde{\epsilon}$ and σ can be calculated theoretically. As presented here they are local functions, i.e. the material is presumed to have no special effects due to the surface, and the anomalous skin effect has been ignored in obtaining $\tilde{\epsilon}$ from the measured data. This latter effect[2,5] can be significant for single crystals at and below room temperature in the near, and especially the far, infrared. The data can be applied without correction to evaporated films, whose mean free path is usually short. To deal properly with single crystals in the infrared, whenever interband absorption does not dominate, one should abandon the $\tilde{\epsilon}$ concept and work with the reflectance itself or the surface impedance[2], $\tilde{Z} = (4\pi/c)\tilde{E}/\tilde{H}$, where the fields are the tangential components evaluated at the surface. Then $\tilde{r} = (4\pi/c-\tilde{Z})/(4\pi/c+\tilde{Z})$ at normal incidence.

Finally, we have presented room temperature or liquid helium temperature data only. Many applications require data at high temperature, e.g., optical pyrometry and solar-thermal energy applications. Provided oxides or surface roughness do not increase at the higher temperatures, one can use the room temperature data for many applications. There are two ways to obtain the temperature dependence. One can make measurements, e.g. of the reflectance at all temperatures of interest, but in addition to the problems of enhanced oxidation and possible surface roughening at high temperature, problems with sample evaporation and the blackbody radiation of the sample itself arise. At temperatures above ~1000 K the emissivity is usually what is measured, by comparing the radiation from the sample with that from a cavity, often in the sample itself. The other method

measures directly the temperature derivative of the reflectance or absorptance of the sample, by modulation spectroscopic techniques with a calibration determined by a steady-state calorimetric method.

REFERENCES

1. M. Born and E. Wolf, "Principles of Optics". (Pergamon Press, London, 1959).

2. F. Stern, Solid State Physics 15, 299 (1963).

3. L.D. Landau and E.M. Lifshitz, "Electrodynamics of Continuous Media", (Addison-Wesley, Reading, Mass., 1965).

4. A.V. Sokolov, "Optical Properties of Metals", (Blackie, London, 1967).

5. F. Wooten, "Optical Properties of Solids", (Academic, New York, 1972).

6. H. Wolter, Handbuch der Physik 24, 461 (1956).

7. J.F. Nye, "Physical Properties of Crystals", (Oxford University Press, London, 1957).

8. C.S. Smith, Solid State Physics 6, 175 (1958).

9. M. Altarelli, D.L. Dexter, H.M. Nussenzveig, and D.Y. Smith, Phys. Rev. B 6, 175 (1958).

10. A. Villani and A.H. Zimmerman, Phys. Rev. B 8, 3914 (1973).

11. M. Altarelli and D.Y. Smith, Phys. Rev. B 9, 1290 (1974); B 12, 3511 (1975).

12. D.Y. Smith, Phys. Rev. B 12, 5303 (1976).

13. E. Shiles, T. Sasaki, M. Inokuti, and D.Y. Smith, Phys. Rev. B 22, 1612 (1980).

14. H. Raether, "Springer Tracts in Modern Physics", Vol. 38 (Springer-Verlag, Berlin, 1965).

15. J. Daniels, C.v. Festenberg, H. Raether, and K. Zeppenfield, "Springer Tracts in Modern Physics", Vol. 54 (Springer-Verlag, Berlin, 1970).

16. H. Raether, "Springer Tracts in Modern Physics", Vol. 88 (Springer-Verlag, Berlin, 1980).

17. H.P. Baltes, "Progress in Optics", XIII, 1 (1976) ed. E. Wolf.

18. R. Siegel and J.R. Howell, "Thermal Radiation Heat Transfer", (McGraw-Hill, New York 1972) p. 109.

19. D.W. Lynch, J. de Physique Suppl. 77, 15-21 (1977).

20. I. Simon, J. Opt. Soc. Am. 41, 334 (1951).

REFERENCES (cont'd)

21. W.R. Hunter, J. Opt. Soc. Am. 55, 1197 (1965).

22. W.R. Hunter, Appl. Opt. 6, 2140 (1967).

23. D.G. Avery, Proc. Phys. Soc. (London) B65, 425 (1952).

24. R.E. Lindquist and A.W. Ewald, J. Opt. Soc. Am. 53, 247 (1963).

25. B.F. Armally et al., Appl. Opt. 11, 2907 (1972).

26. S.P.F. Humphreys-Owen, Proc. Phys. Soc. (London) 77, 949 (1961).

27. R.F. Potter, J. Opt. Soc. Am. 54, 904 (1964).

28. R.F. Potter, Appl. Opt. 4, 53 (1965).

29. O. Hunderi, Appl. Opt. 11 1572 (1972).

30. A. Balzarotti, P. Picozzi, and S. Santucci, Surf. Sci. 37, 994 (1973).

31. W.R. Hunter, J. Opt. Soc. Am. 54, 15 (1964); 55, 1197 (1965).

32. U.S. Whang, E.T. Arakawa, and T.A. Callcott, J. Opt. Soc. Am. 61, 740 (1971).

33. U.S. Whang, E.T. Arakawa, and T.A. Callcott, Phys. Rev. B 5, 2118 (1972); B 6, 2409 (1972).

34. P.O. Nilsson, Appl. Opt. 7, 435 (1968).

35. F. Abeles and M.L. Theye, Surf. Sci. 5, 325 (1966).

36. G. Baldini and L. Rigaldi, J. Opt. Soc. Am. 60, 495 (1970).

37. L. Ward and A. Nag, Brit. J. Appl. Phys. 18, 277 (1967).

38. L. Ward and A. Nag. J. Phys. D 3, 462 (1970).

39. R.F. Miller, A.J. Taylor, and L.S. Julien, J. Phys. D 3, 1957 (1970).

40. J.E. Nestell and R.W. Christy, Appl. Opt. 11, 643 (1972).

41. R.A. MacRae, E.T. Arakawa, and M.W. Williams, Phys. Rev. 162, 615 (1967).

42. B.W. Veal and A.P. Paulikas, Phys. Rev. B 10, 1280 (1974).

43. D.E. Thomas, Bell Syst. Tech. 26, 870 (1947).

44. E.L. Krieger, D.J. Olechna, and D.S. Story, General Electric Corp. Report No. 63-RL-3458G, September 1963.

REFERENCES (cont'd)

45. P.O. Nilsson and L. Munkby, Phys. Kond. Mat. 10 290 (1969).

46. B. Velicky, Czech. J. Phys. B 11, 787 (1961).

47. V.K. Miloslavskii, Opt. Spectroscop. 21, 193 (1961).

48. D.M. Roessler, Brit. J. Appl. Phys. 16, 1359 (1965).

49. G. Leveque, J. Phys. C 10, 4877 (1977).

50. D.W. Berreman, Appl. Opt. 6, 1519 (1967).

51. G.M. Hale, W.E. Holland, and M.R. Querry, Appl. Opt. 12, 48 (1973).

52. C.W. Peterson and B.W. Knight, J. Opt. Soc. Am. 63, 1238 (1973).

53. D.M. Roessler, Brit. J. Appl. Phys. 17, 1313 (1966).

54. R. Klucker and U. Nielsen, Computer Phys. Comm. 6, 187 (1973).

55. D.Y. Smith, J. Opt. Soc. Am. 67, 570 (1977).

56. H.W. Verleur, J. Opt. Soc. Am. 58, 1356 (1968).

57. J. Rivory, Optics Commun. 1, 334 (1970).

58. D.E. Aspnes, "Optical Properties of Solids, New Developments", (North Holland, Amsterdam, 1976) ed. B.O. Seraphin, p. 799.

59. H.E. Bennett and J.M. Bennett, "Physics of Thin Films", Vol. 4 (Academic Press, New York, 1967) ed. G. Hass and R.E. Thun, p. 1.

60. H.E. Bennett and J.O. Porteus, J. Opt. Soc. Am. 51, 123 (1961).

61. H.E. Bennett, J. Opt. Soc. Am. 53, 1389 (1963).

62. J.O. Porteus, J. Opt. Soc. Am. 53, 1294 (1963).

63. D.W. Berreman, Phys. Rev. 163, 855 (1967); B 2, 381 (1970).

64. A.J. Bevolo, B.J. Beaudry, and K.A. Gschneidner, Jr., J. Electrochem. Soc. 127, 2556 (1980).

65. D.E. Aspnes, Phys. Rev. B 21, 3290 (1980).

66. O. Hunderi, Phys. Rev. B 15, 3419 (1973).

67. S.R. Nagel and S.E. Schnatterly, Phys. Rev. B 9, 1299 (1974).

Table 1. List of abbreviations used in the figures and tables.

$\varepsilon_1, \varepsilon_2$	real and imaginary parts of the complex dielectric function, $\tilde{\varepsilon}(\omega) = \varepsilon_1 + i\varepsilon_2$
$-\mathrm{Im}(\tilde{\varepsilon}^{-1}), -\mathrm{Im}(\tilde{\varepsilon}+1)^{-1}$	volume and surface loss functions
KK	Kramers-Kronig analysis
μ	absorption coefficient
RT	room temperature, ~300 K
n,k	index of refraction and extinction coefficient, $\tilde{N}(\omega) = n + ik$
σ	optical conductivity, $\sigma = \varepsilon_2\omega/4\pi$
T	temperature; transmission (if it appears in data presentation column)
A	absorptivity, A = 1 - R
R	reflectivity or reflectance
$\vec{E} \parallel \vec{c}$, $\vec{E} \perp \hat{c}$	$\vec{E}$ = electric field vector; $\hat{c}$ = crystallographic c-axis for hcp metals where c is orthogonal to the basal plane
$\varepsilon, \varepsilon_H, \varepsilon_N$	emissivity, hemispherical emissivity, normal emissivity
MP	mechanical polishing
Ex, In	ex situ, in situ
uhv	ultra high vacuum (generally ~10^{-9} Torr or better)
TEM	transmission electron microscopy
LEED	low energy electron diffraction
AES	Auger electron spectroscopy
Trans	transmission
Refl	reflection
m-θ	multi-angle
Ellips	ellipsometry
Sput	Argon-sputtering, generally implies post-sputtering annealing
EP	electropolish
CP	chemically polished

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Cu-2
HKS68	35-250	Trans		x				μ	absorption measurements with synchrotron radiation
PS69	1.7-5.9	Refl	77-920			x	Heat	ε_2/λ	temperature dependent absorption measurements
SeS70	0.5-11.8	Refl				x	EP	R	
JC72	0.5-6.5	Trans, Refl		x			Ex	$n,k,\varepsilon_1,\varepsilon_2$	
SN72	0.41-1.24	Ellips				x	Heat	σ	
HGK74	13-150	Trans		x			Ex	KK: $\varepsilon_1,\varepsilon_2,n,k,\mu,R,$ $Im(\varepsilon^{-1})$	absorption measurements with synchrotron radiation
WeG74	20-120			x				μ	energy loss spectroscopy
HGK75	13-150	Trans		x			In	KK: μ	absorption measurements with synchrotron radiation
JC75	0.5-6.5	Trans, Refl	78, 300, 423	x				n,k,ε_2	same data as JC72
RT75	2-6	Trans, Refl		x			Ex	ε_2	thin films
HGK76	30-150	Trans		x				KK: μ	absorption measurements with synchrotron radiation
MR76	0.4-0.8	Refl	10-310	x		x	EP	A	absorptivity measurements by calorimetry

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Cu-1
Sa39	2.6-27.6	Refl		x			Ex	R	
JK54	~2.07-4.96	Ellips		x				$-\varepsilon_1,\mu$	
Sch54	1.31-2.76	Trans, Refl Ellips		x				k	
Sc54	0.41-1.24	Trans, Refl		x				$n/\lambda,k/\lambda$	
ST54	1.31-3.1	Refl		x				KK: n	R measured at 45° angle of incidence
Ho55	0.08-1.24	Ellips		x				σ	
Bio56	0.38-4.13	Refl	4.2			x	EP	A	absorptivity measured by calorimetry
Sch57	1.31-3.1	Trans		x				n,k	
Ott61	1.88-2.82	Ellips			x			$-\varepsilon_1,\varepsilon_2$	
DH64	0.06-5.64	Refl		x				R	
SG64	1.88-2.82	Ellips		x			In	ε_1	
Bea65	2.7-27	m-9				x	EP	R,$\varepsilon_1,\varepsilon_2$, and KK: $\varepsilon_1,\varepsilon_2$	
DoM65	0.09-0.99	Ellips		x				n,k	
BG68	0.11-1.24	Refl	4.2			x	EP	A	absorptivity measured by calorimetry, see also Bio56

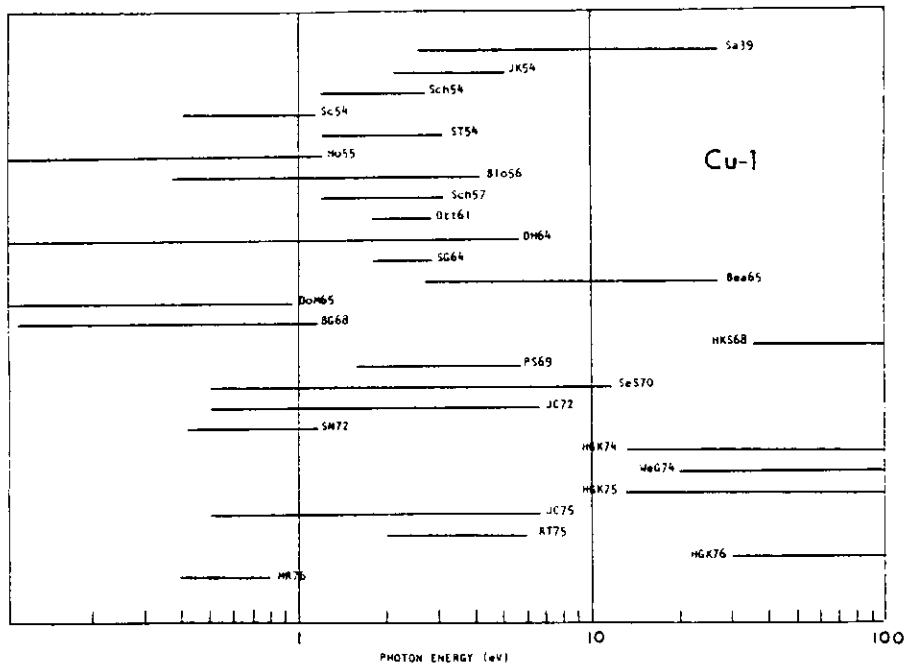

Fig. 2 Survey of available data on Cu.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Cu-3
BT77	18-31	m-θ		x			In	log R	R measured at 30° angle of incidence with synchrotron radiation
FDS77	0.5-40	Trans		x				KK: $\varepsilon_1, \varepsilon_2$	energy loss spectroscopy
RYE77			150-1000					ε_H	emissivity
Sm77	1.96, 2.27	Ellips				x	Sput	n,k	extensive surface studies, MP, anneal, sputtered, AES
BCT79	18-35	m-θ		x			In	$\varepsilon_1, \varepsilon_2, \beta$	
Ben Unpl	0.16-4.3		4.2			x	CP	A	absorptivity measured by calorimetry
We Unpl	0.2-1.8		4.2			x	CP	A	absorptivity measured by calorimetry

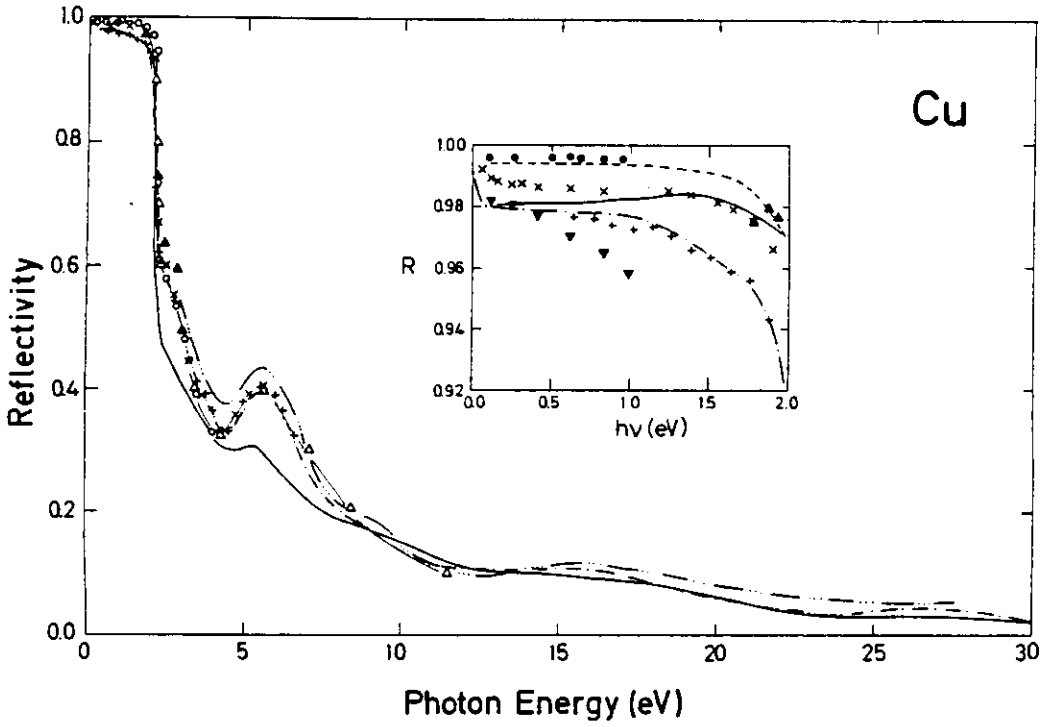

Fig. 3 Reflectivity of Cu. Results by Wea Unpub. (---); Ben Unpub (ooo); DH64 (xxx), SS70 (ΔΔΔ), JC72 (+++), BG68 (•••); FDS77 (——); DoM65 (▼▼▼); Ott61 (▲▲▲); HGK75 (—·—); Bea65 (—··—).

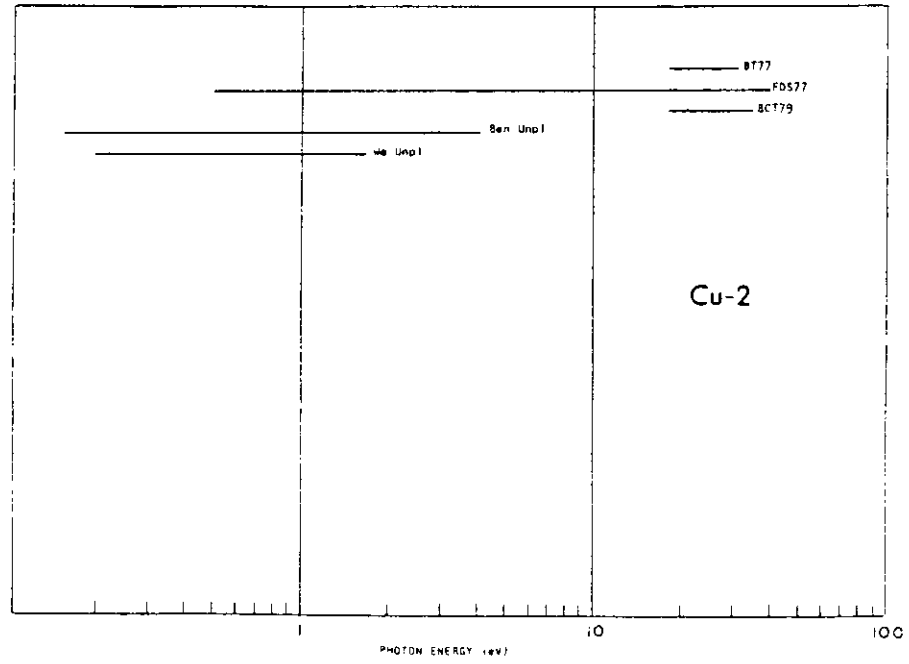

Fig. 2 Survey of available data on Cu.

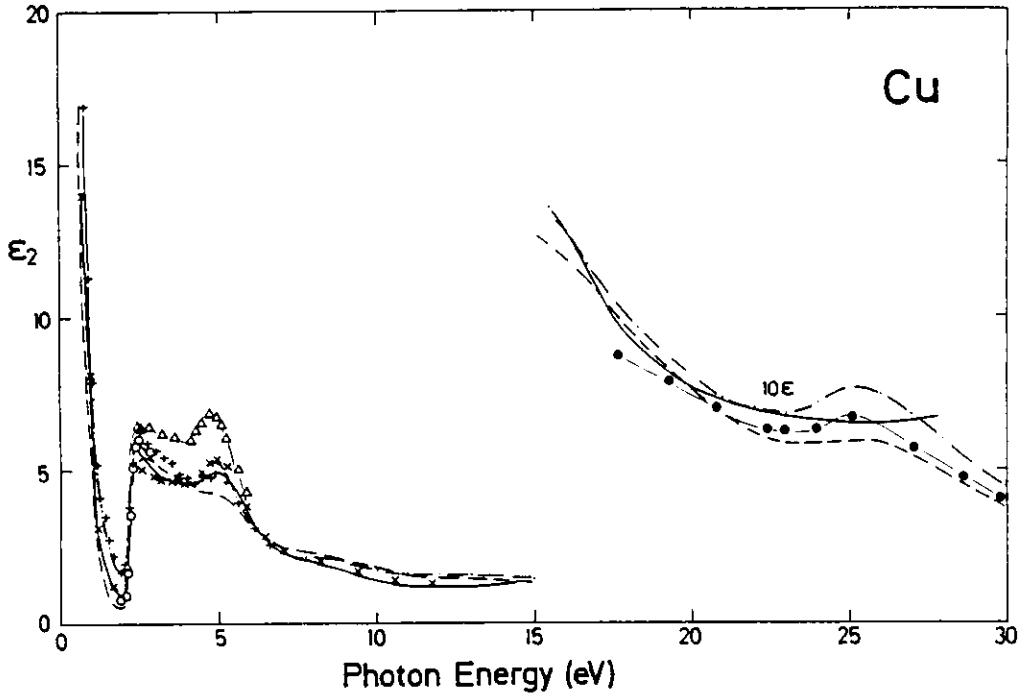

Fig. 5 ε_2 for Cu. Results by Bea65 (——); JC72 (+++); SS70 (xxx); RT75 (ΔΔΔ), Ott61 (ooo); BCT79 (•••); FDS77 (---); HGK75 (—·—).

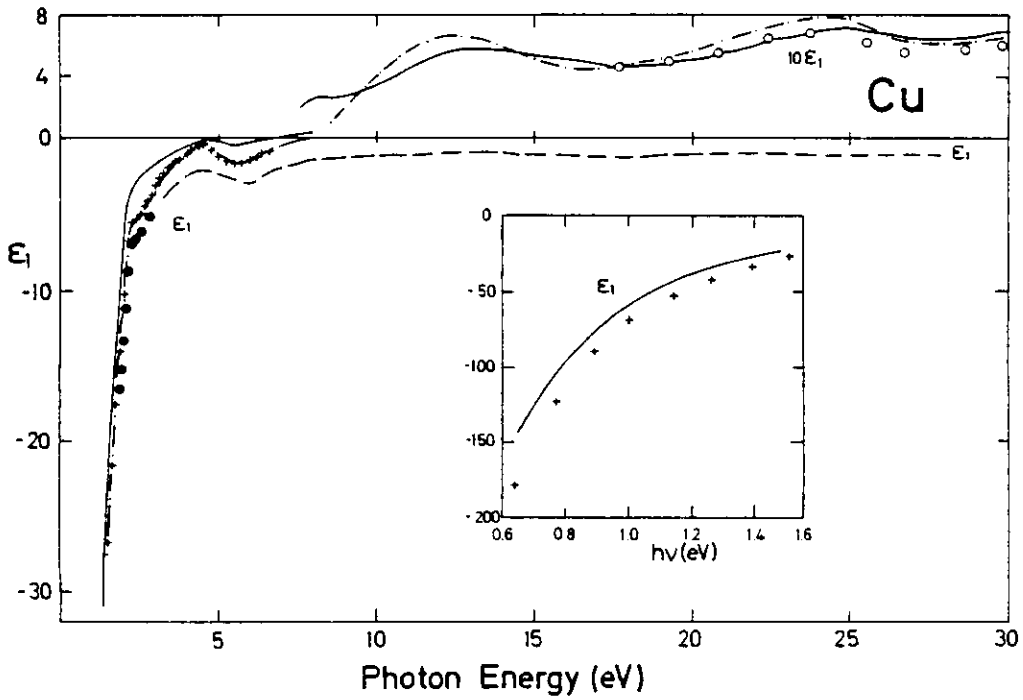

Fig. 4 ε_1 for Cu. Results by JC72 (+++); BCT79 (ooo); Ott61 (•••); FDS77 (——); HGK75 (—·—); Bea65 (---).

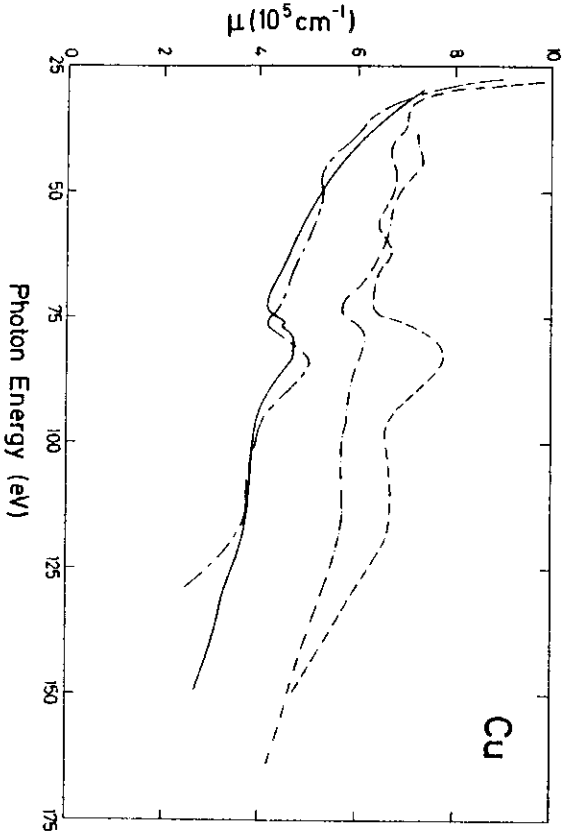

Fig. 6 Absorption coefficient for Cu. Results by HKS68 (—·—); WG74 (— — —); HGK75 (·····); HGK74 (——).

Copper

publication by H.J. Hagemann, W. Gudat, and C. Kunz in J. Opt. Soc. Am. 65, 742 (1975) based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-4240.00	4250.00	29.69	71.57	0.00	.980
0.50	-308.00	609.40	1.71	17.83	0.00	.979
1.00	-71.80	7.39	0.44	8.44	0.00	.976
1.50	-27.60	2.73	0.26	5.26	0.00	.965
1.70	-19.60	1.96	0.22	4.43	0.01	.955
1.75	-18.00	1.82	0.21	4.25	0.01	.956
1.80	-16.30	1.72	0.21	4.04	0.01	.952
1.85	-14.80	1.66	0.22	3.85	0.01	.947
1.90	-13.40	1.57	0.21	3.67	0.01	.944
2.00	-10.40	1.76	0.27	3.24	0.02	.910
2.10	-7.67	2.03	0.47	2.81	0.04	.814
2.20	-6.09	4.30	0.83	2.60	0.08	.673
2.30	-5.64	5.38	1.04	2.59	0.09	.614
2.40	-5.52	5.83	1.12	2.60	0.09	.602
2.60	-4.94	5.77	1.15	2.50	0.10	.577
2.80	-4.22	5.52	1.17	2.36	0.11	.545
3.00	-3.47	5.23	1.18	2.21	0.13	.509
3.20	-2.76	5.09	1.23	2.07	0.15	.468
3.40	-2.20	4.96	1.27	1.95	0.17	.434
3.60	-1.79	4.90	1.31	1.87	0.18	.407
3.80	-1.48	4.82	1.34	1.81	0.19	.387
4.00	-1.15	4.62	1.34	1.72	0.20	.364
4.20	-0.88	4.46	1.42	1.64	0.21	.335
4.40	-0.47	4.87	1.49	1.64	0.20	.329
4.60	-0.47	5.07	1.52	1.67	0.20	.334
4.80	-0.59	5.26	1.53	1.71	0.19	.345
5.00	-1.01	5.23	1.47	1.78	0.18	.356
5.20	-1.33	4.95	1.38	1.80	0.19	.380
5.40	-1.55	4.55	1.28	1.78	0.20	.389
5.60	-1.61	4.11	1.18	1.74	0.21	.391
5.80	-1.58	3.69	1.10	1.67	0.23	.384
6.00	-1.46	3.30	1.04	1.59	0.25	.380
6.50	-0.96	2.62	0.96	1.37	0.34	.329
7.00	-0.50	2.34	0.97	1.20	0.41	.271
7.50	-0.19	2.20	1.00	1.09	0.45	.230
8.00	-0.01	2.12	1.03	1.03	0.47	.206
8.50	0.10	2.02	1.03	0.98	0.49	.189
9.00	0.20	1.89	1.03	0.92	0.52	.171
9.50	0.31	1.78	1.03	0.87	0.55	.154
10.00	0.41	1.70	1.04	0.82	0.56	.139
11.00	0.59	1.62	1.07	0.75	0.55	.118
12.00	0.66	1.60	1.09	0.73	0.54	.111
13.00	0.65	1.57	1.08	0.72	0.54	.109
14.00	0.59	1.53	1.06	0.72	0.57	.111
14.50	0.56	1.48	1.03	0.72	0.59	.111
15.00	0.52	1.43	1.01	0.71	0.62	.111
15.50	0.48	1.36	0.98	0.69	0.65	.109
16.00	0.46	1.26	0.95	0.67	0.69	.106
17.00	0.45	1.13	0.91	0.62	0.76	.097

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Ag-1
Sa39	2.6-27.6	Refl		x			Ex	R	
JK54	∿2.7-4.5	Ellips	20, 428	x				$\mu,-\varepsilon_1$	
Sc54	0.41-1.24	Trans, Refl		x			Ex	$n/\lambda, k/\lambda$	
Sch54	1.31-2.76	Refl, Ellips		x			Ex	k	
ST54	1.31-3.1	Refl		x			Ex	KK: n	R measured at 45° angle of incidence
Ho55	0.08-1.24	Ellips		x				log nkν, $\log(1-\varepsilon_1)$, σ	
Bio56	0.38-4.13	Refl	4.2			x	EP	A	absorptivity measured by calorimetry
Bea57	0.01-0.25	Ellips			x			$k/\lambda, n/\lambda^2$	
Sch57	1.31-3.1	Trans		x				n,k	
Ott61	1.88-2.82	Ellips			x		Ex	$\varepsilon_1, \varepsilon_2$	
Wes63	1.8-5.0	Refl				x	EP	R	Au-Ag alloys
DH64	0.03-5.64	Refl		x				R	
HAM64	3.35-4.96	m-θ		x			In	R,n,k,ε_1,ε_2,Im(ε^{-1})	10^{-6} Torr
LSE64	109-539	Trans		x			Ex	μ	

Cu

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(4=0)
19.00	0.48	1.00	0.89	0.56	0.82	.004
19.50	0.52	0.90	0.88	0.51	0.83	.971
20.00	0.57	0.80	0.88	0.45	0.83	.959
21.00	0.63	0.74	0.90	0.41	0.84	.948
22.00	0.70	0.70	0.92	0.38	0.72	.010
23.00	0.76	0.69	0.94	0.37	0.80	.035
24.00	0.79	0.72	0.96	0.37	0.83	.035
25.00	0.78	0.76	0.96	0.40	0.85	.040
26.00	0.69	0.74	0.92	0.40	0.73	.034
27.00	0.63	0.68	0.89	0.38	0.79	.043
28.00	0.62	0.60	0.86	0.35	0.80	.039
29.00	0.63	0.51	0.85	0.30	0.78	.032
30.00	0.66	0.45	0.86	0.26	0.80	.025
31.00	0.71	0.42	0.88	0.24	0.82	.020
32.00	0.74	0.40	0.89	0.22	0.86	.017
33.00	0.77	0.38	0.90	0.21	0.52	.015
34.00	0.79	0.37	0.91	0.20	0.49	.014
35.00	0.80	0.36	0.92	0.20	0.47	.013
36.00	0.81	0.35	0.92	0.19	0.45	.012
37.00	0.82	0.35	0.92	0.19	0.44	.011
38.00	0.83	0.33	0.93	0.18	0.42	.010
39.00	0.83	0.32	0.93	0.17	0.40	.009
40.00	0.85	0.31	0.93	0.17	0.38	.009
41.00	0.85	0.30	0.94	0.16	0.37	.008
42.00	0.86	0.30	0.94	0.16	0.36	.007
43.00	0.87	0.29	0.94	0.15	0.35	.007
44.00	0.88	0.29	0.95	0.15	0.34	.007
45.00	0.88	0.28	0.95	0.15	0.33	.006
46.00	0.88	0.28	0.95	0.15	0.32	.006
47.00	0.88	0.27	0.95	0.14	0.32	.006
48.00	0.89	0.27	0.95	0.14	0.31	.006
49.00	0.89	0.26	0.95	0.14	0.30	.005
50.00	0.89	0.25	0.95	0.13	0.30	.005
51.00	0.89	0.25	0.95	0.13	0.29	.005
52.00	0.89	0.24	0.95	0.13	0.28	.005
53.00	0.90	0.23	0.96	0.12	0.27	.004
54.00	0.90	0.23	0.96	0.12	0.26	.004
55.00	0.90	0.22	0.96	0.12	0.26	.004
56.00	0.91	0.22	0.96	0.11	0.25	.004
57.00	0.91	0.22	0.96	0.11	0.24	.004
58.00	0.92	0.21	0.96	0.11	0.24	.004
59.00	0.92	0.21	0.97	0.11	0.24	.003
60.00	0.92	0.21	0.97	0.11	0.23	.003
61.00	0.92	0.21	0.97	0.11	0.23	.003
62.00	0.92	0.21	0.97	0.11	0.23	.003
63.00	0.92	0.20	0.96	0.10	0.23	.003
64.00	0.92	0.20	0.96	0.10	0.22	.003
65.00	0.92	0.19	0.97	0.10	0.21	.003
66.00	0.93	0.19	0.97	0.10	0.21	.003
67.00	0.93	0.18	0.97	0.09	0.20	.003
68.00	0.93	0.18	0.97	0.09	0.20	.002
69.00	0.93	0.18	0.97	0.09	0.20	.002
70.00	0.94	0.17	0.97	0.09	0.19	.002
75.00	0.96	0.17	0.98	0.09	0.18	.002
80.00	0.94	0.19	0.98	0.09	0.20	.002
85.00	0.93	0.17	0.97	0.09	0.20	.002
90.00	0.92	0.15	0.96	0.08	0.17	.002

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Ag-3
				Film	X-tal	Bulk	Prep		
Sch72	2-40	Trans		x				$Im(\varepsilon^{-1})$; KK: $\varepsilon_1,\varepsilon_2$	energy loss spectroscopy
HGK74	13-150	Trans		x			Ex	KK: $\varepsilon_1,\varepsilon_2,n,k,\mu,R,$ $Im(\varepsilon^{-1})$	absorption measurements with synchrotron radiation
WeG74	~25-100	Trans		x			Ex	μ	energy loss spectroscopy
FS75	1.4-5.25	Ellips		x			Ex	$\varepsilon_1,\varepsilon_2$	substrate T = 100°C
HGK75	13-150	Trans		x			Ex	KK: μ	absorption measurements with synchrotron radiation
RT75	2-6	Trans, Refl		x				ε_2	
MR76	0.4-0.8	Refl	10-310			x	EP	A	absorptivity measured by calorimetry
WKL76	0.5-5.4	Ellips	40-840		x	x	EP	ε_2	
RYE77			150-1000					ε_H	emissivity
We Unpl	0.165-3.0	Refl	4.2		x		CP	A	absorptivity measured by calorimetry

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Ag-2
				Film	X-tal	Bulk	Prep		
DoM65	0.09-0.99	Ellips		x			Ex	n,k	
YS65	0.89-4.64	Ellips		x				n,μ	
BB66	0.04-2.5	Refl		x			Ex	R	uhv films on fused quartz (rms roughness ~3 Å)
FS66	~2.2-4.3	m-θ		x				R,n,k,$\varepsilon_1,\varepsilon_2$	
Ro66	3-60	Refl		x			Ex	R,$\varepsilon_1,\varepsilon_2$, $Im(\varepsilon^{-1})$	plotted R at θ = 18°; plotted $\varepsilon_1,\varepsilon_2$ from two-angles of incidence technique
Dan67		Trans		x				$Im(\varepsilon^{-1})$, $Im(\varepsilon+1)^{-1}$	energy loss spectroscopy
MFK67	2.1-4.7	Ellips		x			Ex	n,k,$\varepsilon_1,\varepsilon_2$	
BBA68	0.05-0.31	Refl		x				R	
HKS68	35-250	Trans		x				μ	absorption measurements with synchrotron radiation
Dan69	5-75	Trans		x			Ex	$Im(\varepsilon^{-1})$, KK: $\varepsilon_1,\varepsilon_2$	energy loss spectroscopy
HW71	2-11	Refl		x			In	KK: n,k	uhv films measured in situ
IrH71	1.1-11.5	Refl	300	x			In	R; KK: $\varepsilon_1,\varepsilon_2$, $Im(\varepsilon^{-1})$	uhv films measured in situ; Ag and Ag alloys
JC72	0.5-6.5	Trans, Refl		x			Ex	n,k,$\varepsilon_1,\varepsilon_2$	

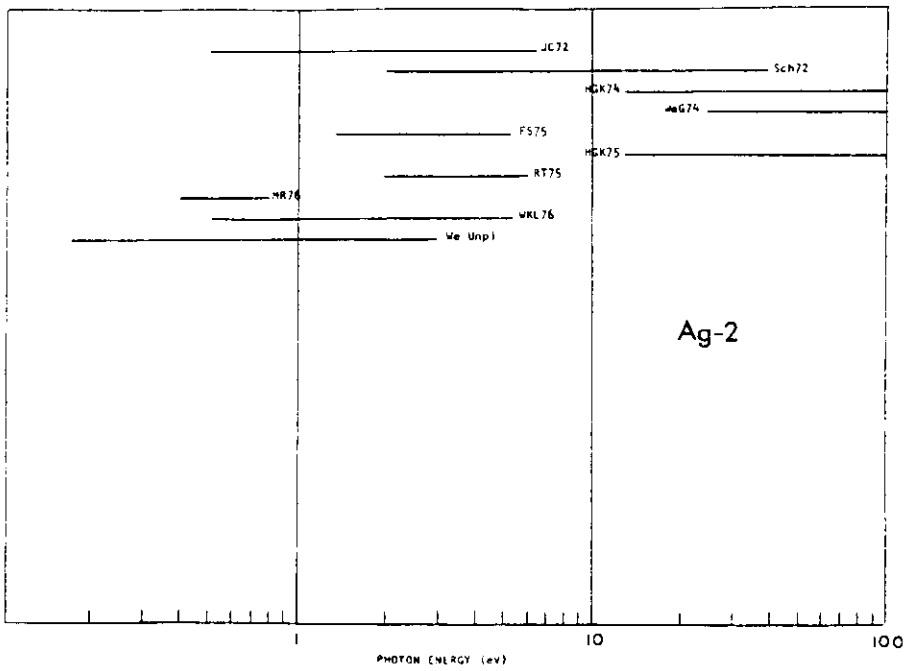

Fig. 7 Survey of available data on Ag.

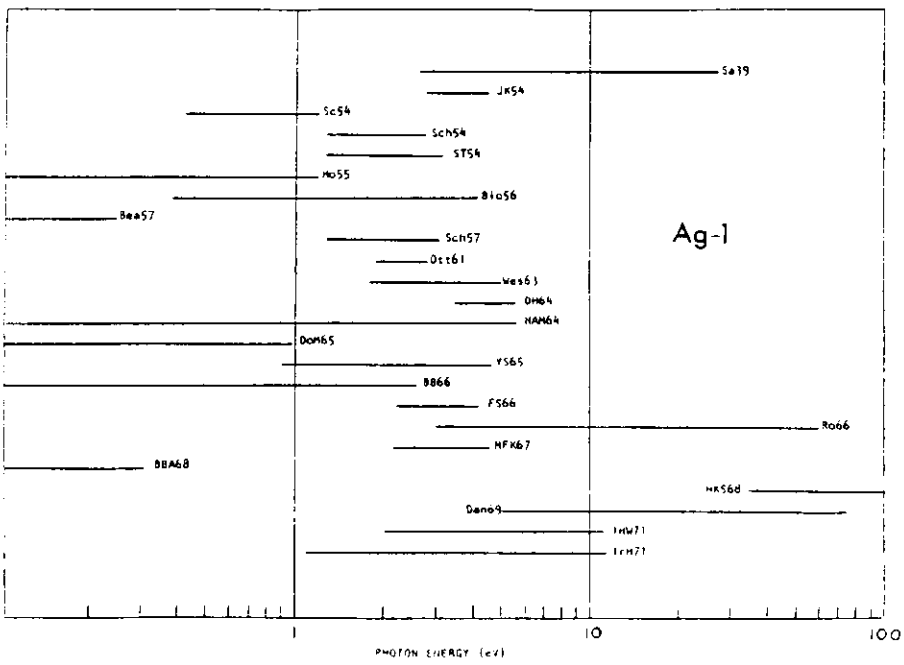

Fig. 7 Survey of available data on Ag.

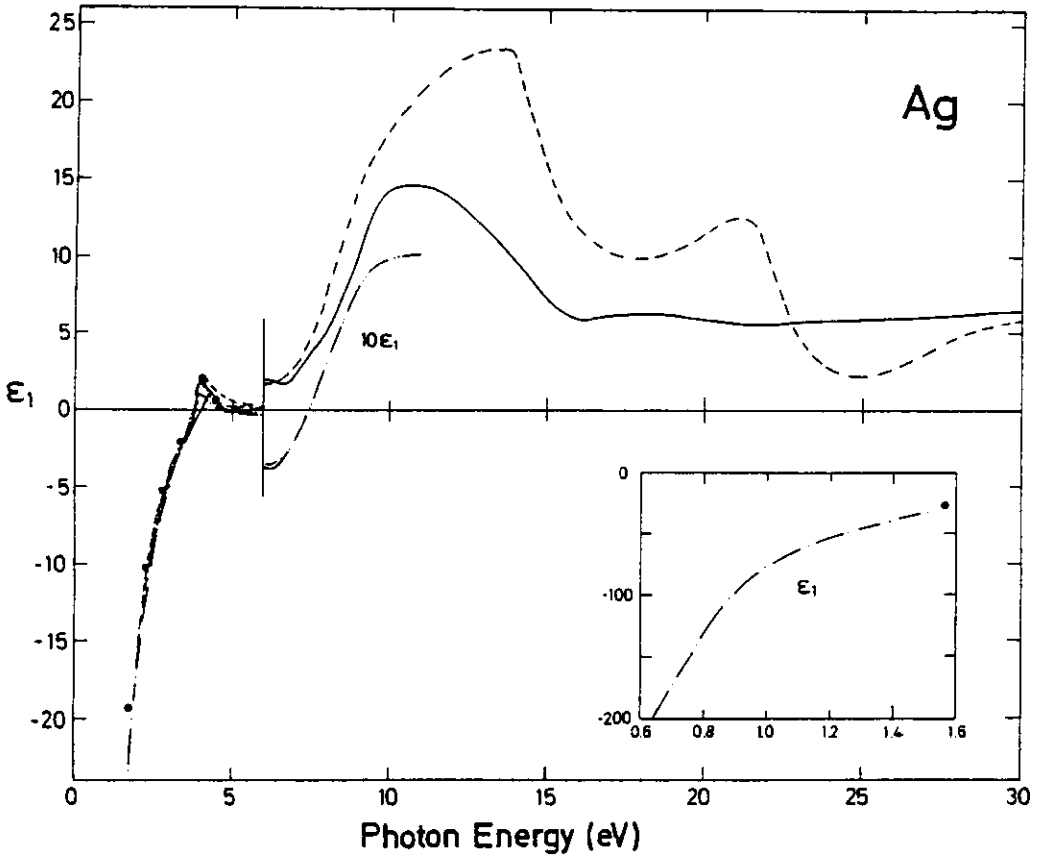

Fig. 9 ε_1 for Ag. Results by MFK67 (---); HAM64 (···); FS75 (●●●); Ro66 (——); IHW71 (—·—); JC72 (—·—); HGK75 (— — —).

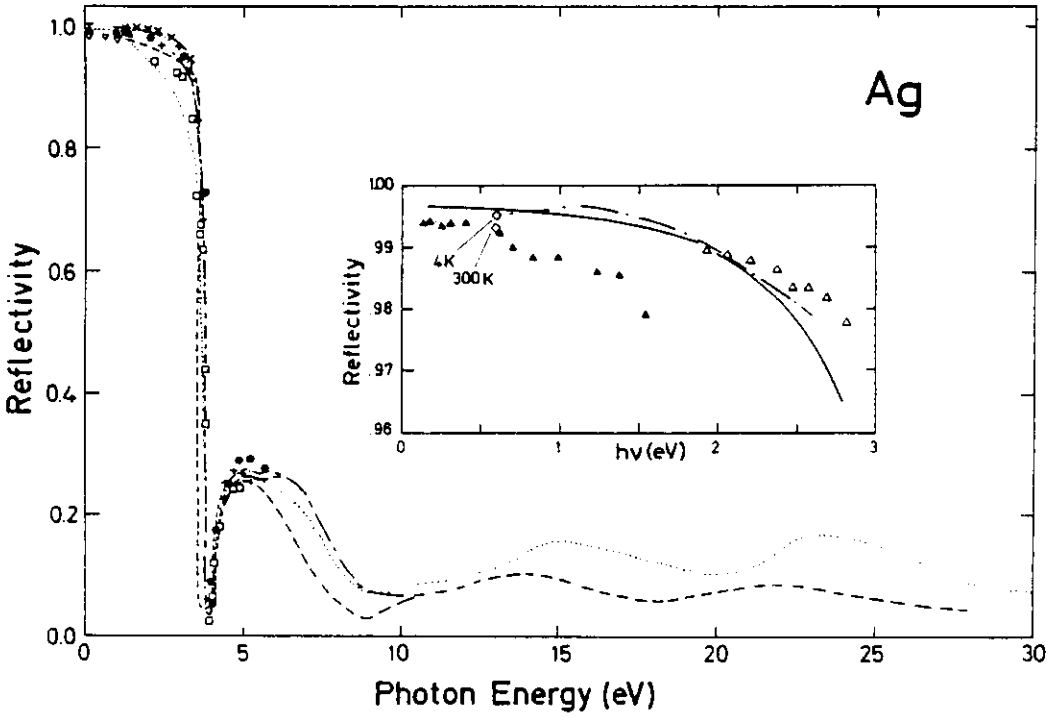

Fig. 8 Reflectivity for Ag. Results by Wea Unpub. (——); MR76 (◇◇◇); Ott61 (ΔΔΔ); JC72 (—·—); IHW71 (— · —); Ro66 (---); FS66 (ooo); BB66 (▲▲▲); DH64 (●●●); Bio56 (xxx); Wes63 (+++); DoM65 (▽▽▽); HGK75 (···).

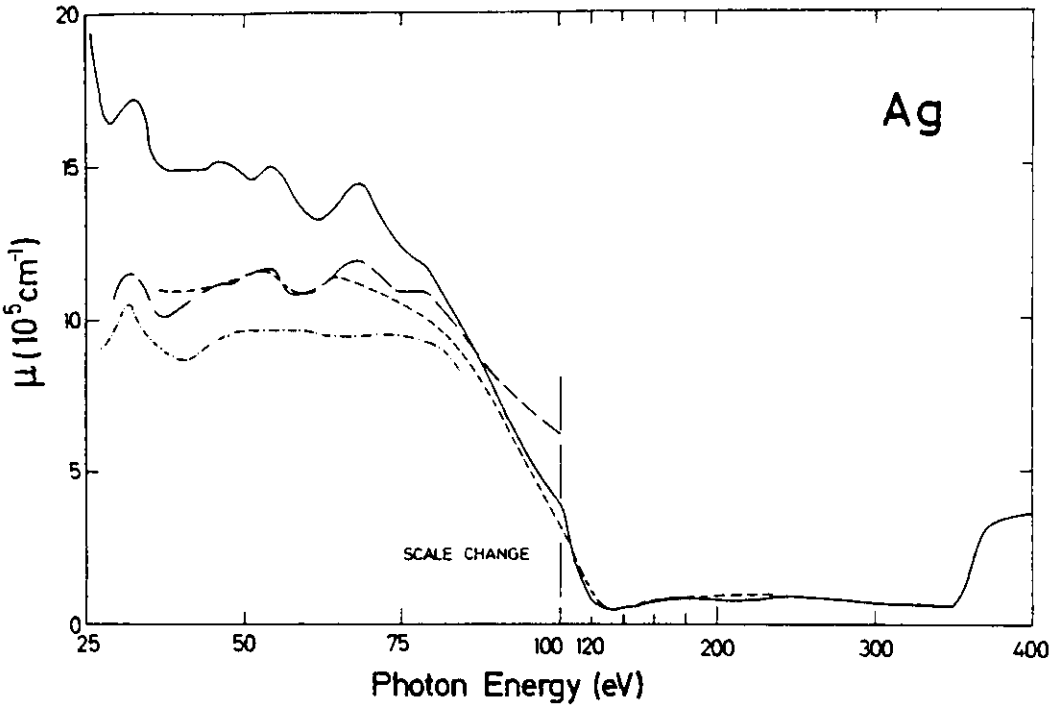

Fig. 11 Absorption coefficient for Ag. Results by HGK75 (——); WG74 (– –); HKS68 (---); Dan69 (–·–).

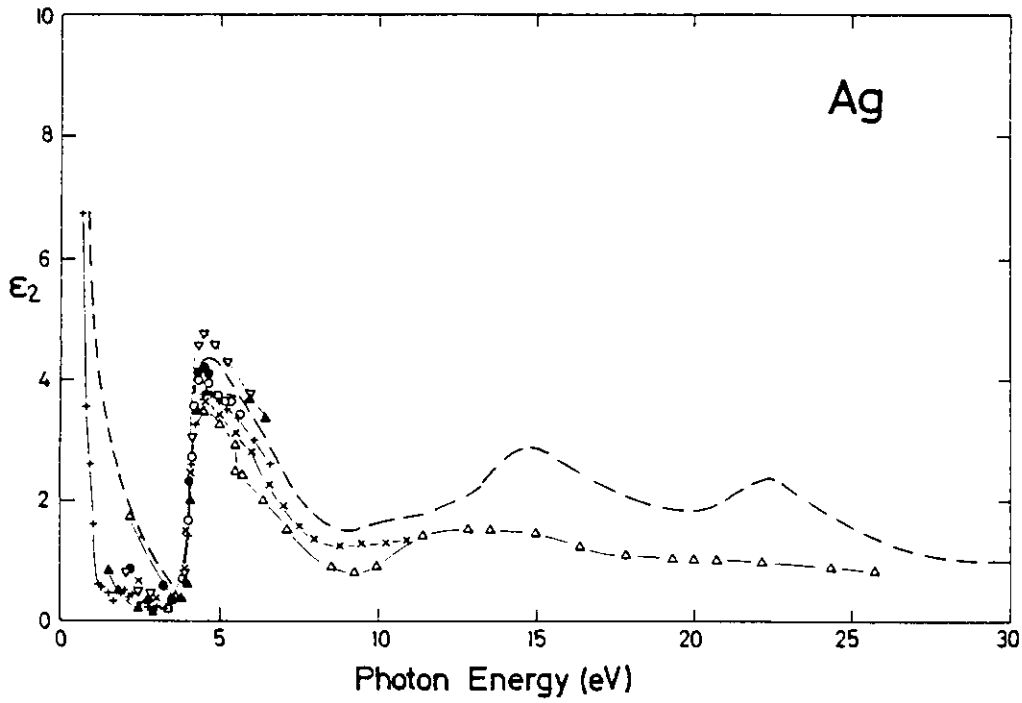

Fig. 10 ε_2 for Ag. Results by JC72 (+++); HW71 (xxx); Ro66 (□□□); FS75 (▲▲▲); RT75 (???); HAM64 (ooo); MFK67 (•••); HGK75 (– –).

Silver

publication by H.J. Hagemann, W. Gudat, and C. Kunz in J. Opt. Soc. Am. 65, 742 (1975) based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
0.10	-8050.00	1790.00	9.91	90.27	0.00	.995
0.20	-2040.00	200.00	2.84	45.70	0.00	.995
0.30	-929.00	66.10	1.41	30.51	0.00	.994
0.40	-523.00	41.60	0.91	22.89	0.00	.993
0.50	-335.00	24.50	0.67	18.32	0.00	.992
1.00	-81.50	5.64	0.28	9.03	0.00	.987
1.50	-33.50	3.14	0.27	5.79	0.00	.969
2.00	-17.40	2.25	0.27	4.18	0.01	.944
2.50	-9.51	1.47	0.24	3.09	0.02	.914
3.00	-5.12	1.03	0.23	2.27	0.04	.864
3.25	-3.42	0.85	0.23	1.86	0.07	.816
3.50	-1.96	0.80	0.21	1.42	0.14	.750
3.60	-1.22	0.52	0.23	1.13	0.29	.671
3.70	-0.50	0.46	0.30	0.77	1.00	.475
3.77	0.12	0.42	0.53	0.40	2.20	.154
3.80	0.44	0.44	0.73	0.30	1.14	.053
3.90	1.55	0.94	1.30	0.36	0.29	.040
4.00	2.25	1.94	1.61	0.60	0.22	.103
4.10	2.26	2.92	1.73	0.85	0.21	.153
4.20	1.94	3.72	1.75	1.06	0.21	.194
4.30	1.70	3.92	1.73	1.13	0.21	.208
4.50	1.23	4.33	1.69	1.28	0.21	.238
4.75	0.80	4.32	1.61	1.34	0.22	.252
5.00	0.56	4.20	1.55	1.36	0.23	.257
5.50	0.29	3.88	1.45	1.34	0.26	.257
6.00	0.16	3.42	1.34	1.28	0.29	.246
6.50	0.18	2.96	1.25	1.18	0.34	.225
7.00	0.27	2.49	1.18	1.06	0.40	.196
7.50	0.47	2.08	1.14	0.91	0.46	.157
8.00	0.78	1.75	1.16	0.75	0.48	.114
9.00	1.44	1.49	1.33	0.56	0.35	.074
10.00	1.83	1.63	1.46	0.56	0.27	.082
11.00	2.00	1.71	1.52	0.56	0.25	.088
12.00	2.24	1.89	1.61	0.59	0.22	.100
13.00	2.33	2.12	1.66	0.64	0.21	.112
14.00	2.35	2.69	1.72	0.78	0.21	.141
14.50	1.94	2.88	1.64	0.88	0.24	.152
15.00	1.59	2.86	1.56	0.92	0.27	.156
16.00	1.19	2.59	1.42	0.91	0.32	.151
17.00	1.02	2.30	1.33	0.86	0.36	.139
18.00	0.99	2.06	1.28	0.80	0.39	.124
19.00	1.04	1.90	1.27	0.75	0.41	.111
20.00	1.15	1.84	1.29	0.71	0.39	.103
21.00	1.26	2.01	1.35	0.75	0.36	.112
21.50	1.23	2.19	1.37	0.80	0.35	.124
22.00	1.02	2.34	1.34	0.87	0.36	.141
22.50	0.73	2.36	1.26	0.93	0.39	.157
23.00	0.49	2.21	1.17	0.94	0.43	.163
23.50	0.35	2.05	1.10	0.93	0.47	.165

Ag

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
24.00	0.26	1.68	1.04	0.90	0.52	.165
24.50	0.22	1.72	0.99	0.87	0.57	.168
25.00	0.21	1.57	0.95	0.83	0.63	.154
25.50	0.23	1.42	0.91	0.78	0.69	.144
26.00	0.27	1.32	0.90	0.74	0.73	.133
26.50	0.31	1.23	0.89	0.69	0.76	.121
27.00	0.36	1.15	0.89	0.65	0.79	.109
27.50	0.42	1.10	0.89	0.62	0.80	.099
28.00	0.47	1.06	0.90	0.59	0.79	.090
28.50	0.50	1.04	0.91	0.57	0.78	.081
29.00	0.54	1.02	0.92	0.56	0.77	.079
30.00	0.57	1.01	0.93	0.54	0.75	.074
31.00	0.58	1.00	0.93	0.53	0.75	.072
32.00	0.57	0.97	0.92	0.53	0.77	.072
33.00	0.54	0.93	0.90	0.51	0.80	.071
34.00	0.51	0.86	0.88	0.49	0.84	.067
35.00	0.54	0.79	0.96	0.45	0.86	.061
36.00	0.59	0.78	0.89	0.44	0.81	.055
38.00	0.64	0.89	0.89	0.39	0.77	.043
40.00	0.67	0.86	0.90	0.37	0.75	.039
42.00	0.68	0.83	0.90	0.35	0.73	.036
44.00	0.70	0.80	0.90	0.33	0.71	.033
46.00	0.70	0.76	0.90	0.32	0.70	.031
48.00	0.69	0.73	0.89	0.31	0.70	.030
50.00	0.70	0.51	0.84	0.29	0.68	.027
52.00	0.71	0.49	0.89	0.28	0.65	.024
54.00	0.71	0.49	0.88	0.27	0.66	.024
56.00	0.69	0.45	0.87	0.26	0.66	.024
58.00	0.70	0.41	0.87	0.24	0.63	.021
60.00	0.71	0.38	0.87	0.22	0.59	.018
62.00	0.73	0.37	0.88	0.21	0.55	.016
64.00	0.74	0.37	0.88	0.21	0.54	.016
66.00	0.74	0.37	0.88	0.21	0.55	.016
68.00	0.71	0.36	0.87	0.21	0.58	.017
70.00	0.65	0.34	0.83	0.20	0.63	.021
72.00	0.69	0.31	0.85	0.16	0.54	.016
74.00	0.70	0.28	0.85	0.17	0.50	.014
76.00	0.70	0.27	0.85	0.16	0.47	.013
78.00	0.70	0.25	0.85	0.15	0.46	.013
80.00	0.70	0.23	0.85	0.14	0.43	.012
85.00	0.70	0.19	0.85	0.11	0.36	.011
90.00	0.72	0.14	0.85	0.08	0.26	.009
95.00	0.74	0.10	0.86	0.06	0.18	.007
100.00	0.76	0.07	0.87	0.04	0.11	.005

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Au-2
				Film	X-tal	Bulk	Prep		
DoM65	0.09-0.99	Ellips		x				n,k	
BB66	0.04-2.5	Refl		x			Ex	R	uhv films on fused quartz (rms roughness ~3Å)
FS66	~2.2-4.3	m-θ		x				R,n,k,ε_1,ε_2	
JM66	103-477	Trans		x			Ex	μ	absorption measurements with synchrotron radiation
MFK67	2.1-4.7	Ellips		x				n,k,ε_1,ε_2	
Sco67	2-10	Refl		x			Ex	R, $\Delta R/R$	temperature modulated reflectance, $\Delta R/R$ measured
HKS68	35-250	Trans		x				μ	absorption measurements with synchrotron radiation
Ho68	0.5-6.0	Refl		x				KK: $-\varepsilon_1$,ε_2	gold-silica interface
PS69	0.5-5.9	Refl	295-770			x	Heat	ε_2/λ	temperature dependent absorption measurements
DFR70	25-90							μ	energy loss spectroscopy
Th70	0.6-6	Trans, Refl		x			Ex	ε_2/λ,$-\varepsilon_1$,ε_2	uhv films annealed and characterized
Hu71	0.62-60	Refl		x			Ex	R	
IHW71	2-11	Refl		x			In	KK: n,k	uhv films and Au-Al alloys
IHW72	1.1-11.5	Refl	300, 100	x			In	R; KK: ε_1,ε_2,n,k, $\mathrm{Im}(\varepsilon^{-1})$	uhv films

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Au-1
				Film	X-tal	Bulk	Prep		
Sa39	2.6-27.6	Refl		x			Ex	R	
JK54	~2.07-4.43	Ellips		x				μ,$-\varepsilon_1$	
Sc54	0.41-1.24	Trans, Refl		x				n/λ,k/λ	
Sch54	1.31-2.76	Refl,Ellips		x				K	
ST54	1.31-3.1	Refl		x				KK: n	R measured at 45° angle of incidence
Ho55	0.08-1.24	Ellips		x				log nkν, log $(1-\varepsilon_1)$,σ	
Sch57	1.31-3.1	Trans		x				n,k	
Ott61	1.88-2.82	Ellips			x			ε_1,ε_2	
BVK62	0.12-0.62	Ellips				x		n,k,ε_1,ε_2,R	
Wes63	1.8-5.0	Refl				x	EP	R	Au-Ag alloys
CHH64	6.2-41.3	m-θ		x			In	R	10^{-6} Torr
DH64	0.03-5.64	Refl		x				R	
LSE64	109-539	Trans		x			Ex	μ	
Bea65	2.7-27	m-θ				x	EP	ε_1,ε_2, and KK:ε_1,ε_2	
CEP65	~.1-60							R; KK: ε_1,ε_2,$\mathrm{Im}(\varepsilon^{-1})$	KK analysis of data from Has63 and CHH64

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Au-4
BCT79	18-35	m-θ		x			In	$\varepsilon_1,\varepsilon_2,\mu$	
SJ79	0.31		300-430	x				A	absorptivity measured by calorimetry at different temperatures
AKB80	1.5-5.8	Ellips		x				$\varepsilon_1,\varepsilon_2$	studied sample effects
Hun Unpl	1.31-4.13		4.2, 300	x			Ex	A	absorptivity measured by calorimetry
Th Pvt	0.6-6	Trans, Refl		x			Ex	R	uhv films annealed and characterized
We Unpl	0.26-4.2	Refl	4.2		x		EP	A	absorptivity measured by calorimetry

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Au-3
JC72	0.5-6.5	Trans, Refl		x			Ex	$n,k,\varepsilon_1,\varepsilon_2$	
Li72	6.2-31	m-θ		x				R,n,k	
Sch72	2-40	Trans		x				$Im(\varepsilon^{-1})$; KK: $\varepsilon_1,\varepsilon_2$	energy loss spectroscopy
Aks74	0.12-1.24		373-673					ε_N	emissivity
HGK74	13-150	Trans		x			Ex	KK: $\varepsilon_1,\varepsilon_2$,n,k,μ,R, $Im(\varepsilon^{-1})$	absorption measurements with synchrotron radiation
WeG74	2-120	Refl		x				μ	energy loss spectroscopy
FLS75	0.08-4.1	Refl		x				R; KK: n,k	Au-Cr alloys RF sputtered on 150°C glass
HGK75	13-150	Trans		x			Ex	KK: μ	absorption measurements with synchrotron radiation
GH76	0.5-4.13	Trans		x				T	ultra fine gold particles
MR76	0.4-0.8		10-310	x		x	EP	A	absorptivity measured by calorimetry
WKL76	0.5-5.4	Ellips	40-840			x	EP	ε_2	plotted figure is at T = 295°K
BT77	18-35	m-θ		x			In	log R	R measured at 30° angle of incidence with synchrotron radiation
HKL77	1.85-2.43	Ellips	1.5, 300	x				$-\varepsilon_1,\varepsilon_2$	plotted data is at T = 300°K
MHS77	∿2-2.6	Trans		x			Ex	n,k	

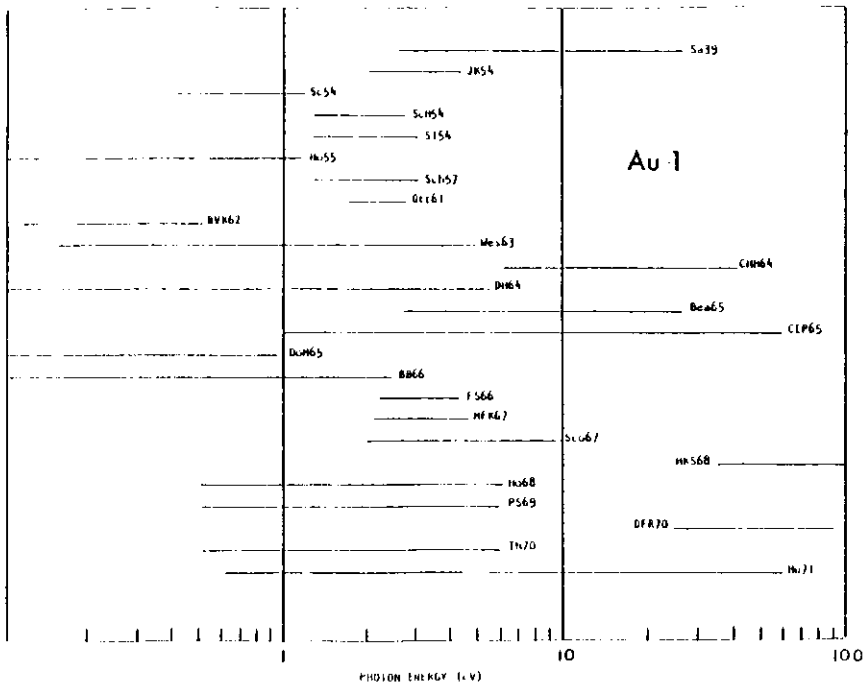

Fig. 12 Survey of available data on Au.

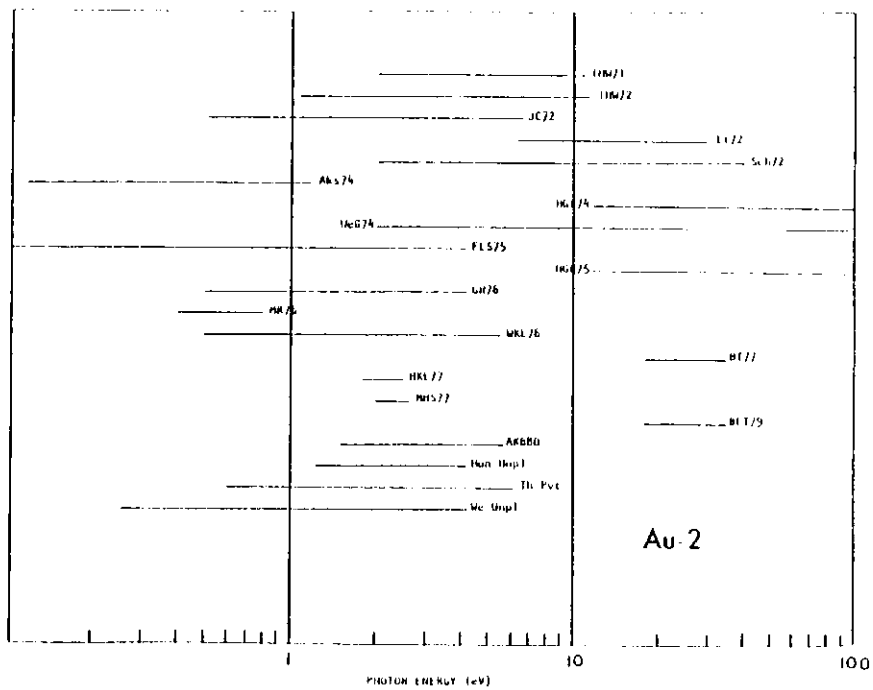

Fig. 12 Survey of available data on Au.

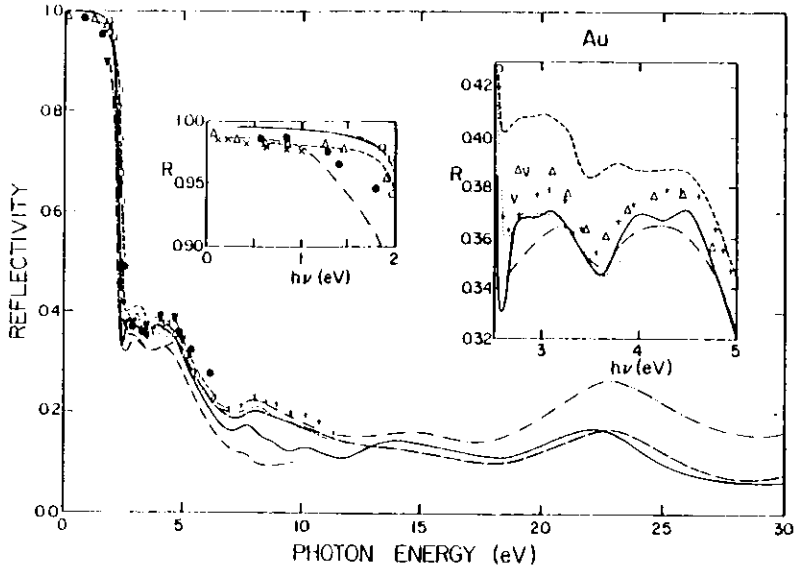

Fig. 13 Reflectivity of Au. Results by We Unpub (~0.2-4 eV) and OL Unpub (~4-30 eV) (——); HGK75 (—·—); MHS77 (ooo); Hu71 (···); Li72 (– – –); CHH74 (long dashes > 6 eV); Sco67 (—··—); DH64 (ΔΔΔ); Wes63 (▼▼▼); FS66 (long dashes < 5 eV); IHW71 (+++); DoH65 (xxx); Ott61 (VVV); AKB80 (medium dashes ~1.5-6 eV); JC72 (short dashes ~6-6.4 eV); FLS75 (•••); HKL77 (□□□).

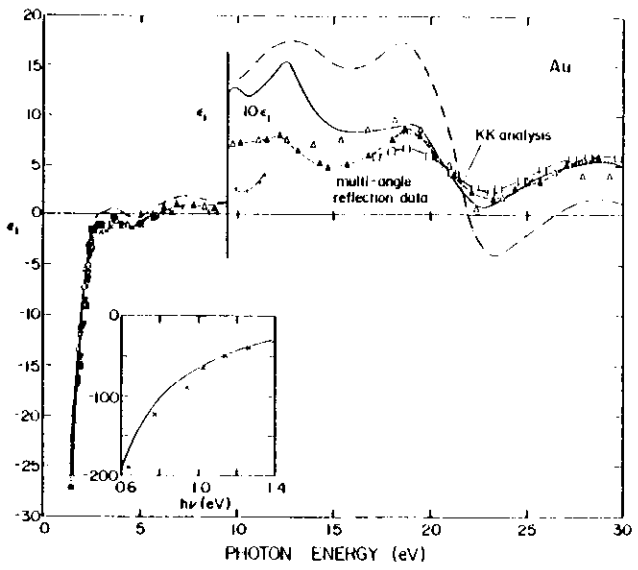

Fig. 14 ε_1 for Au. Results by We Unpub (~0.2-4 eV) and OL Unpub (~4-30 eV) (——); IHW71 (+++); CHH64 (▲▲▲); JC72 (xxx); BCT79 (··· is KK analysis, □□□ is multiangle reflection); Ho68 (■■■); Ott61 (VVV); HKL77 (▼▼▼); AKB80 (•••); HGK75 (—·—); CEP65 (ooo); MFK67 (ΔΔΔ).

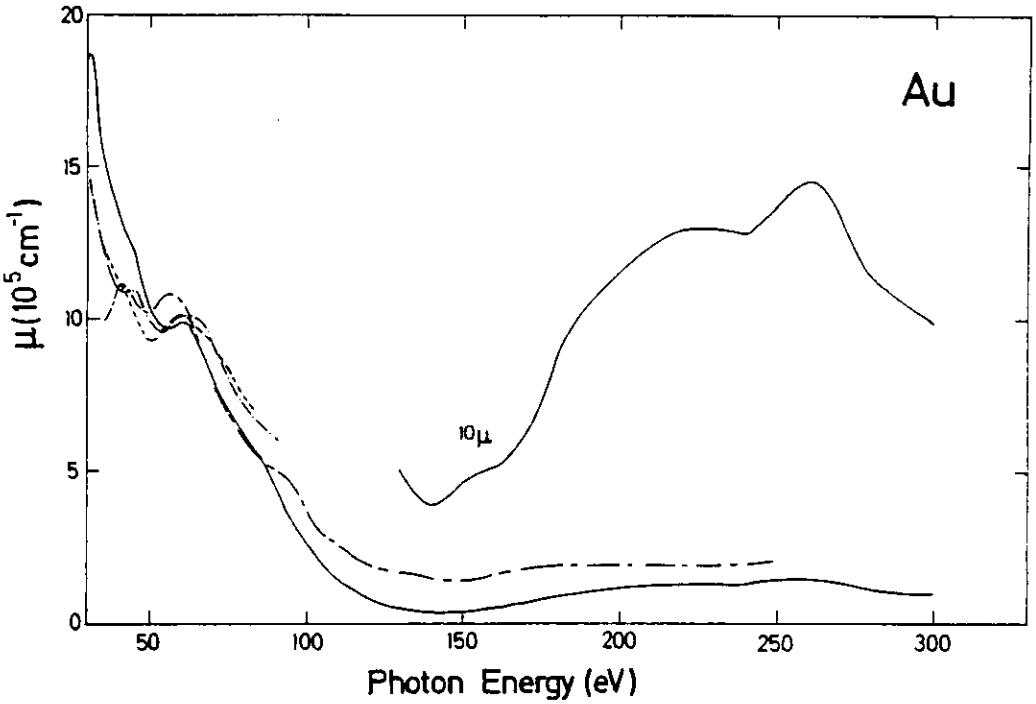

Fig. 16 Absorption coefficient for Au. Results by HGK75 (——); HKS68 (— - —); DFR70 (---); WG74 (—·—).

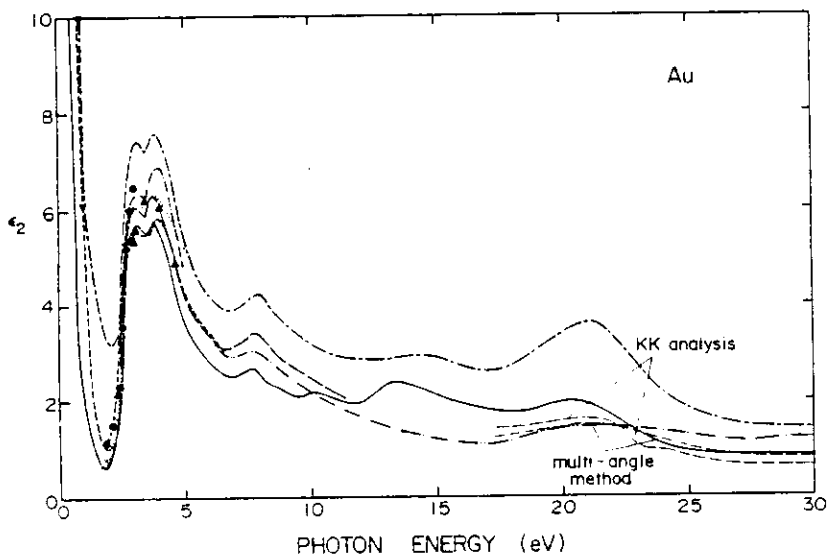

Fig. 15 ϵ_2 of Au. Results by We Unpub (-0.2-4 eV) and OL Unpub (-4-30 eV) (——); JC72 (---); AKB80 (...); CHH64 (—·—); THW71 (— —); HGK75 (— - —); Th70 (—·—); Ho68 (•••); MFK67 (▲▲▲); Ott61 (+++); DoM65 (▼▼▼); HKL77 (xxx); Bea65 (— —, ~17-30 eV).

Gold

Unpublished reflectance data for electropolished Au(110) by J.H. Weaver ($0.2 \leq h\nu \leq 4$ eV) and C.G. Olson and D.W. Lynch ($-4 \leq h\nu \leq 30$ eV). Optical constants determined by Kramers-Kronig analysis.

Energy (eV)	ε_1	ε_2	n	k	$\mathrm{Im}(-1/\tilde{\varepsilon})$	$R(\phi=0)$
0.10	-6794.55	1353.43	8.17	82.83	0.00	.995
0.15	-3071.68	411.93	3.71	55.55	0.00	.995
0.20	-1737.03	178.14	2.13	41.73	0.00	.995
0.25	-1113.45	93.15	1.39	33.40	0.00	.995
0.30	-773.00	55.32	0.99	27.82	0.00	.995
0.35	-567.39	35.69	0.75	23.83	0.00	.995
0.40	-433.63	24.47	0.59	20.83	0.00	.995
0.45	-341.72	17.44	0.47	18.49	0.00	.994
0.50	-275.84	12.97	0.39	16.61	0.00	.994
0.55	-227.06	9.92	0.33	15.07	0.00	.994
0.60	-189.92	7.78	0.28	13.78	0.00	.994
0.65	-160.96	6.21	0.24	12.69	0.00	.994
0.70	-137.95	5.07	0.22	11.75	0.00	.994
0.75	-119.34	4.24	0.19	10.93	0.00	.994
0.80	-104.21	3.59	0.18	10.21	0.00	.993
0.85	-91.62	3.09	0.16	9.57	0.00	.993
0.90	-81.07	2.66	0.15	9.01	0.00	.993
0.95	-72.13	2.31	0.14	8.49	0.00	.993
1.00	-64.47	2.03	0.13	8.03	0.00	.992
1.10	-52.16	1.61	0.11	7.22	0.00	.992
1.20	-42.77	1.31	0.10	6.54	0.00	.991
1.30	-35.43	1.09	0.09	5.95	0.00	.990
1.40	-29.57	0.92	0.08	5.44	0.00	.989
1.50	-24.79	0.79	0.08	4.98	0.00	.988
1.60	-20.82	0.70	0.08	4.56	0.00	.986
1.70	-17.46	0.64	0.08	4.18	0.00	.984
1.80	-14.58	0.65	0.09	3.82	0.00	.979
1.90	-12.11	0.75	0.11	3.49	0.01	.968
2.00	-9.98	0.85	0.13	3.16	0.01	.953
2.05	-8.98	0.91	0.15	3.00	0.01	.942
2.10	-8.05	1.01	0.18	2.84	0.02	.925
2.15	-7.19	1.12	0.21	2.69	0.02	.905
2.20	-6.37	1.22	0.24	2.54	0.03	.880
2.25	-5.58	1.32	0.28	2.38	0.04	.849
2.30	-4.80	1.43	0.32	2.22	0.06	.807
2.33	-4.39	1.48	0.35	2.13	0.07	.780
2.35	-3.97	1.58	0.39	2.03	0.09	.743
2.38	-3.57	1.72	0.44	1.94	0.11	.697
2.40	-3.19	1.87	0.50	1.86	0.14	.647
2.42	-2.83	2.05	0.58	1.78	0.17	.592
2.45	-2.49	2.22	0.65	1.71	0.20	.538
2.47	-2.16	2.42	0.74	1.64	0.23	.485
2.50	-1.86	2.62	0.82	1.59	0.25	.438
2.53	-1.53	2.85	0.92	1.54	0.27	.393
2.55	-1.22	3.13	1.03	1.51	0.28	.358
2.58	-0.97	3.47	1.15	1.51	0.27	.336
2.60	-0.84	3.84	1.24	1.54	0.25	.331
2.63	-0.78	4.17	1.32	1.58	0.23	.334
2.65	-0.77	4.47	1.37	1.63	0.22	.340

Au

Energy (eV)	ε_1	ε_2	n	k	$\mathrm{Im}(-1/\tilde{\varepsilon})$	$R(\phi=0)$
2.67	-0.82	4.72	1.41	1.68	0.21	.344
2.70	-0.90	4.90	1.43	1.72	0.20	.356
2.72	-0.97	5.01	1.44	1.74	0.19	.363
2.75	-1.00	5.07	1.44	1.76	0.19	.366
2.78	-1.01	5.13	1.45	1.77	0.19	.367
2.80	-1.00	5.18	1.46	1.77	0.19	.368
2.83	-0.99	5.23	1.47	1.78	0.18	.368
2.85	-0.98	5.28	1.48	1.78	0.18	.368
2.88	-0.96	5.33	1.49	1.78	0.18	.368
2.90	-0.94	5.36	1.50	1.79	0.18	.368
2.92	-0.92	5.42	1.51	1.79	0.18	.368
2.95	-0.91	5.47	1.52	1.80	0.18	.368
2.97	-0.90	5.51	1.53	1.80	0.18	.369
3.00	-0.90	5.54	1.54	1.80	0.18	.369
3.05	-0.91	5.59	1.54	1.81	0.17	.370
3.10	-0.91	5.60	1.54	1.81	0.17	.371
3.15	-0.90	5.58	1.54	1.81	0.17	.370
3.20	-0.87	5.56	1.54	1.80	0.18	.369
3.25	-0.82	5.54	1.55	1.79	0.18	.365
3.30	-0.77	5.52	1.55	1.78	0.18	.362
3.35	-0.71	5.50	1.55	1.77	0.18	.359
3.40	-0.65	5.49	1.56	1.76	0.18	.356
3.45	-0.58	5.48	1.57	1.75	0.18	.353
3.50	-0.50	5.49	1.58	1.73	0.18	.349
3.55	-0.43	5.52	1.60	1.73	0.18	.347
3.60	-0.37	5.59	1.62	1.73	0.18	.346
3.65	-0.35	5.67	1.63	1.74	0.18	.347
3.70	-0.39	5.76	1.64	1.75	0.17	.351
3.75	-0.47	5.82	1.64	1.77	0.17	.355
3.80	-0.56	5.83	1.63	1.79	0.17	.360
3.85	-0.66	5.81	1.61	1.80	0.17	.364
3.90	-0.75	5.75	1.59	1.81	0.17	.366
3.95	-0.82	5.68	1.57	1.81	0.17	.368
4.00	-0.87	5.59	1.55	1.81	0.17	.369
4.05	-0.91	5.50	1.53	1.80	0.18	.369
4.10	-0.94	5.42	1.51	1.79	0.18	.368
4.15	-0.95	5.33	1.49	1.78	0.18	.368
4.20	-0.97	5.26	1.48	1.78	0.18	.367
4.25	-0.99	5.20	1.47	1.77	0.19	.367
4.30	-1.03	5.13	1.45	1.77	0.19	.368
4.35	-1.07	5.05	1.43	1.76	0.19	.369
4.40	-1.12	4.95	1.41	1.76	0.19	.370
4.45	-1.16	4.83	1.38	1.75	0.20	.370
4.50	-1.18	4.69	1.35	1.74	0.20	.370
4.55	-1.19	4.55	1.33	1.72	0.21	.368
4.60	-1.16	4.41	1.30	1.69	0.21	.364
4.65	-1.12	4.28	1.28	1.66	0.22	.359
4.70	-1.07	4.16	1.27	1.64	0.23	.354
4.75	-1.02	4.06	1.26	1.61	0.23	.349
4.80	-0.97	3.96	1.25	1.59	0.24	.344
4.85	-0.92	3.86	1.24	1.56	0.25	.338
4.90	-0.86	3.78	1.23	1.54	0.25	.332
4.95	-0.80	3.70	1.22	1.51	0.26	.326
5.00	-0.73	3.62	1.22	1.49	0.27	.319
5.10	-0.62	3.50	1.21	1.44	0.28	.307
5.20	-0.50	3.40	1.21	1.40	0.29	.295
5.30	-0.41	3.30	1.21	1.37	0.30	.285

Au

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
5.40	-0.32	3.22	1.21	1.33	0.31	.275
5.50	-0.23	3.13	1.21	1.30	0.32	.265
5.60	-0.15	3.05	1.21	1.27	0.33	.256
5.70	-0.07	2.98	1.21	1.23	0.34	.246
5.80	0.02	2.90	1.21	1.20	0.34	.236
5.90	0.10	2.84	1.21	1.17	0.35	.227
6.00	0.19	2.79	1.22	1.14	0.36	.218
6.10	0.26	2.74	1.23	1.12	0.36	.210
6.20	0.34	2.70	1.24	1.09	0.36	.203
6.30	0.41	2.66	1.24	1.07	0.37	.196
6.40	0.47	2.63	1.25	1.05	0.37	.190
6.50	0.54	2.59	1.26	1.03	0.37	.184
6.60	0.61	2.56	1.27	1.01	0.37	.177
6.70	0.68	2.53	1.29	0.99	0.37	.172
6.80	0.75	2.52	1.30	0.97	0.36	.167
6.90	0.82	2.53	1.32	0.96	0.36	.164
7.00	0.88	2.54	1.34	0.95	0.35	.162
7.10	0.92	2.56	1.35	0.95	0.35	.161
7.20	0.96	2.58	1.36	0.95	0.34	.161
7.30	0.98	2.61	1.37	0.95	0.34	.162
7.40	0.99	2.64	1.38	0.96	0.33	.164
7.50	0.97	2.67	1.38	0.97	0.33	.166
7.60	0.94	2.69	1.38	0.98	0.33	.169
7.70	0.89	2.69	1.36	0.99	0.34	.171
7.80	0.84	2.65	1.35	0.99	0.34	.171
7.90	0.81	2.59	1.33	0.98	0.35	.169
8.00	0.80	2.52	1.31	0.96	0.36	.165
8.10	0.81	2.46	1.30	0.94	0.37	.160
8.20	0.83	2.40	1.30	0.92	0.37	.155
8.30	0.87	2.36	1.30	0.91	0.37	.151
8.40	0.90	2.33	1.30	0.89	0.37	.147
8.50	0.90	2.33	1.30	0.89	0.37	.147
8.60	0.93	2.31	1.31	0.88	0.37	.145
8.70	0.95	2.29	1.31	0.88	0.37	.144
8.80	0.96	2.28	1.31	0.87	0.37	.142
8.90	0.98	2.25	1.31	0.86	0.38	.140
9.00	1.00	2.21	1.30	0.85	0.38	.137
9.10	1.03	2.17	1.30	0.83	0.38	.133
9.20	1.07	2.14	1.30	0.82	0.38	.130
9.30	1.11	2.11	1.31	0.81	0.38	.126
9.40	1.16	2.09	1.32	0.79	0.37	.124
9.50	1.20	2.09	1.33	0.78	0.37	.122
9.60	1.20	2.09	1.34	0.78	0.36	.121
9.70	1.23	2.11	1.36	0.78	0.35	.121
9.80	1.25	2.14	1.37	0.78	0.35	.123
9.90	1.25	2.16	1.37	0.79	0.35	.124
10.00	1.25	2.17	1.37	0.79	0.35	.125
10.10	1.24	2.18	1.37	0.80	0.35	.126
10.20	1.23	2.18	1.37	0.80	0.35	.126
10.30	1.22	2.18	1.36	0.80	0.35	.127
10.40	1.20	2.17	1.36	0.80	0.35	.126
10.50	1.19	2.15	1.35	0.80	0.36	.125
10.60	1.19	2.13	1.35	0.79	0.36	.124
10.70	1.19	2.11	1.34	0.79	0.36	.123
10.80	1.19	2.09	1.34	0.78	0.36	.122
10.90	1.20	2.07	1.34	0.77	0.36	.120
10.90	1.20	2.05	1.34	0.77	0.36	.118

Au

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
11.00	1.22	2.03	1.34	0.76	0.36	.116
11.10	1.24	2.01	1.34	0.75	0.36	.115
11.20	1.25	2.00	1.34	0.74	0.36	.113
11.30	1.27	1.99	1.35	0.74	0.36	.112
11.40	1.29	1.98	1.35	0.73	0.35	.111
11.50	1.31	1.97	1.36	0.73	0.35	.110
11.60	1.33	1.96	1.36	0.72	0.35	.109
11.70	1.36	1.96	1.37	0.72	0.34	.109
11.80	1.39	1.97	1.38	0.71	0.34	.108
11.90	1.41	1.97	1.39	0.71	0.34	.109
12.00	1.44	1.98	1.39	0.71	0.33	.109
12.10	1.47	2.00	1.40	0.71	0.33	.110
12.20	1.49	2.03	1.42	0.72	0.32	.111
12.30	1.51	2.06	1.43	0.72	0.32	.113
12.40	1.53	2.10	1.44	0.73	0.31	.115
12.50	1.53	2.15	1.44	0.74	0.31	.118
12.60	1.52	2.20	1.45	0.76	0.31	.121
12.70	1.51	2.24	1.45	0.77	0.31	.124
12.80	1.48	2.29	1.45	0.79	0.31	.127
12.90	1.44	2.32	1.44	0.80	0.31	.130
13.00	1.40	2.34	1.44	0.82	0.31	.133
13.10	1.36	2.36	1.43	0.83	0.32	.135
13.20	1.31	2.37	1.42	0.84	0.32	.137
13.30	1.27	2.37	1.41	0.84	0.33	.138
13.40	1.23	2.37	1.40	0.85	0.33	.139
13.50	1.19	2.37	1.38	0.85	0.34	.139
13.60	1.15	2.36	1.37	0.86	0.34	.140
13.70	1.12	2.34	1.36	0.86	0.35	.140
13.80	1.09	2.33	1.35	0.86	0.35	.140
13.90	1.06	2.31	1.34	0.86	0.36	.140
14.00	1.04	2.30	1.33	0.86	0.36	.140
14.10	1.01	2.28	1.32	0.86	0.37	.140
14.20	0.99	2.26	1.31	0.86	0.37	.140
14.30	0.96	2.24	1.30	0.86	0.38	.139
14.40	0.94	2.22	1.29	0.86	0.38	.139
14.50	0.92	2.20	1.29	0.85	0.39	.138
14.60	0.91	2.18	1.28	0.85	0.39	.137
14.70	0.90	2.15	1.27	0.85	0.40	.136
14.80	0.88	2.13	1.26	0.84	0.40	.135
14.90	0.87	2.11	1.26	0.84	0.40	.134
15.00	0.87	2.09	1.25	0.84	0.41	.134
15.10	0.86	2.07	1.24	0.83	0.41	.133
15.20	0.85	2.05	1.24	0.83	0.42	.132
15.30	0.84	2.03	1.23	0.82	0.42	.131
15.40	0.84	2.01	1.23	0.82	0.42	.130
15.50	0.83	2.00	1.22	0.81	0.43	.129
15.60	0.83	1.98	1.22	0.81	0.43	.127
15.70	0.83	1.96	1.22	0.81	0.43	.126
15.80	0.83	1.94	1.21	0.80	0.44	.125
15.90	0.83	1.93	1.21	0.80	0.44	.124
16.00	0.83	1.91	1.21	0.79	0.44	.123
16.20	0.83	1.89	1.20	0.78	0.44	.121
16.40	0.83	1.86	1.20	0.78	0.45	.119
16.60	0.83	1.84	1.19	0.77	0.45	.118
16.80	0.83	1.82	1.19	0.76	0.45	.116
17.00	0.84	1.80	1.19	0.76	0.46	.115
17.20	0.84	1.79	1.19	0.75	0.46	.114

Au

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
17.40	0.85	1.76	1.19	0.75	0.46	.112
17.60	0.85	1.76	1.19	0.73	0.46	.111
17.80	0.86	1.76	1.19	0.74	0.46	.110
18.00	0.87	1.75	1.19	0.74	0.46	.109
18.20	0.88	1.75	1.19	0.73	0.46	.109
18.40	0.89	1.75	1.19	0.73	0.45	.109
18.60	0.89	1.77	1.20	0.74	0.45	.109
18.80	0.90	1.78	1.20	0.74	0.45	.110
19.00	0.90	1.81	1.21	0.75	0.44	.112
19.20	0.89	1.85	1.21	0.76	0.44	.116
19.40	0.86	1.89	1.21	0.78	0.44	.120
19.60	0.82	1.93	1.21	0.80	0.44	.125
19.80	0.76	1.95	1.19	0.82	0.45	.129
20.00	0.70	1.96	1.18	0.83	0.45	.133
20.20	0.64	1.96	1.16	0.84	0.46	.138
20.40	0.58	1.96	1.14	0.85	0.47	.141
20.60	0.52	1.94	1.12	0.86	0.48	.145
20.80	0.46	1.92	1.10	0.87	0.49	.149
21.00	0.39	1.90	1.08	0.88	0.51	.153
21.20	0.33	1.86	1.05	0.88	0.52	.156
21.40	0.27	1.81	1.03	0.88	0.54	.159
21.60	0.22	1.76	1.00	0.88	0.56	.162
21.80	0.17	1.69	0.97	0.87	0.58	.163
22.00	0.14	1.63	0.94	0.86	0.61	.164
22.20	0.11	1.56	0.91	0.85	0.64	.164
22.40	0.10	1.48	0.89	0.83	0.67	.163
22.60	0.09	1.42	0.87	0.81	0.70	.161
22.80	0.09	1.35	0.85	0.79	0.74	.157
23.00	0.10	1.29	0.84	0.77	0.77	.153
23.20	0.12	1.23	0.82	0.75	0.80	.149
23.40	0.13	1.18	0.81	0.73	0.84	.143
23.60	0.15	1.13	0.80	0.70	0.87	.138
23.80	0.17	1.09	0.80	0.68	0.89	.132
24.00	0.20	1.05	0.80	0.66	0.92	.125
24.20	0.22	1.02	0.80	0.64	0.94	.119
24.40	0.25	0.99	0.80	0.62	0.95	.113
24.60	0.28	0.96	0.80	0.60	0.96	.107
24.80	0.30	0.94	0.80	0.58	0.96	.101
25.00	0.33	0.92	0.81	0.57	0.96	.096
25.20	0.36	0.91	0.82	0.56	0.95	.090
25.40	0.38	0.90	0.82	0.55	0.94	.087
25.60	0.40	0.89	0.83	0.54	0.94	.084
25.80	0.41	0.89	0.83	0.53	0.93	.081
26.00	0.43	0.88	0.84	0.52	0.92	.079
26.20	0.44	0.87	0.84	0.52	0.91	.076
26.40	0.45	0.87	0.85	0.51	0.91	.074
26.60	0.46	0.86	0.85	0.51	0.90	.072
26.80	0.47	0.86	0.85	0.50	0.89	.071
27.00	0.48	0.85	0.86	0.50	0.89	.069
27.20	0.49	0.85	0.86	0.49	0.88	.068
27.40	0.50	0.84	0.86	0.49	0.87	.066
27.60	0.51	0.84	0.86	0.49	0.87	.065
27.80	0.52	0.84	0.87	0.48	0.86	.064
28.00	0.53	0.84	0.87	0.48	0.85	.063
28.20	0.53	0.84	0.87	0.48	0.85	.063
28.40	0.54	0.84	0.88	0.48	0.84	.062
28.60	0.54	0.84	0.88	0.48	0.84	.062

Au

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
28.80	0.54	0.85	0.89	0.48	0.84	.062
29.00	0.54	0.85	0.88	0.49	0.84	.063
29.20	0.53	0.85	0.88	0.48	0.84	.063
29.40	0.53	0.85	0.87	0.48	0.85	.064
29.60	0.52	0.84	0.87	0.48	0.85	.064
29.80	0.52	0.84	0.87	0.48	0.85	.064
30.00	0.51	0.83	0.86	0.48	0.87	.064

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Al-2
				Film	X-tal	Bulk	Prep		
MCH63	6.2-12.4	Refl		x			In	R	
DH64	0.04-5.64	Refl		x				R	
Hun64	2.07-41.3	Refl		x				n,k,R	
LSE64	109-539	Trans		x			Ex	μ	
SB64	0.5-2.25	Refl		x				R	
LT65	0.6-4.6	Ellips				x			
BB66	0.04-0.25	Refl		x			Ex	R	uhv films on fused quartz (rms roughness ~3 Å)
Kun66				x					energy loss spectroscopy, uhv ($\sim 10^{-9}$ Torr)
LT66	0.06-0.31	Ellips			x			$-\varepsilon_1, \varepsilon_2/\lambda$	
FL67	30-525	Trans		x			Ex	μ	
BG68	0.11-1.23	Refl	4.2			x	EP	A	absorptivity measured by calorimetry
HSK69	35-310	Trans		x				μ	absorption measurements with synchrotron radiation
Mot69									review paper
BoL70	0.2-5	Refl	4.2			x	EP	A; KK: σ	absorptivity measured by calorimetry
GB70	70-190	Trans		x			Ex	μ	absorption with synchrotron radiation

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Al-1
				Film	X-tal	Bulk	Prep		
Sa39	2.6-27.6	Refl		x				R	
TP51	20.7-155	Trans		x				μ	
Sch54	1.31-2.76	Trans, Refl		x				k	
ST54	1.31-3.1	Refl		x				KK: n	R measured at 45° angle of incidence
Bea55	0.1-0.62	Ellips		x				$\varepsilon_1, \varepsilon_2, n, k, R$	
Ho55	0.08-1.24	Ellips		x				log nkν, log(1-ε_1), σ	
Bea57	0.01-0.25	Ellips		x				$k/\lambda, n/\lambda^2$	
Sch57	1.31-3.1	Trans		x				n,k	
BHM60	6.2-12.4	m-θ		x				R	
GMS60	0.14-1.55	Ellips	78, RT	x				n,k	
HW61	1.91-5.64	Trans, Refl		x			Ex	R,n,k	
MC61	6.2-24.8	Trans, Refl		x				R	
LM62	12-18	Trans						KK: $\varepsilon_1, \varepsilon_2$	energy loss spectroscopy
BSA63	0.77-6.2	Refl		x				R	
EPS63	0-22	Refl						R; KK: $\varepsilon_1, \varepsilon_2$, σ, $\mathrm{Im}(\varepsilon^{-1})$	plots show KK analysis of reflectance data from HW61, MCH63, BSA63

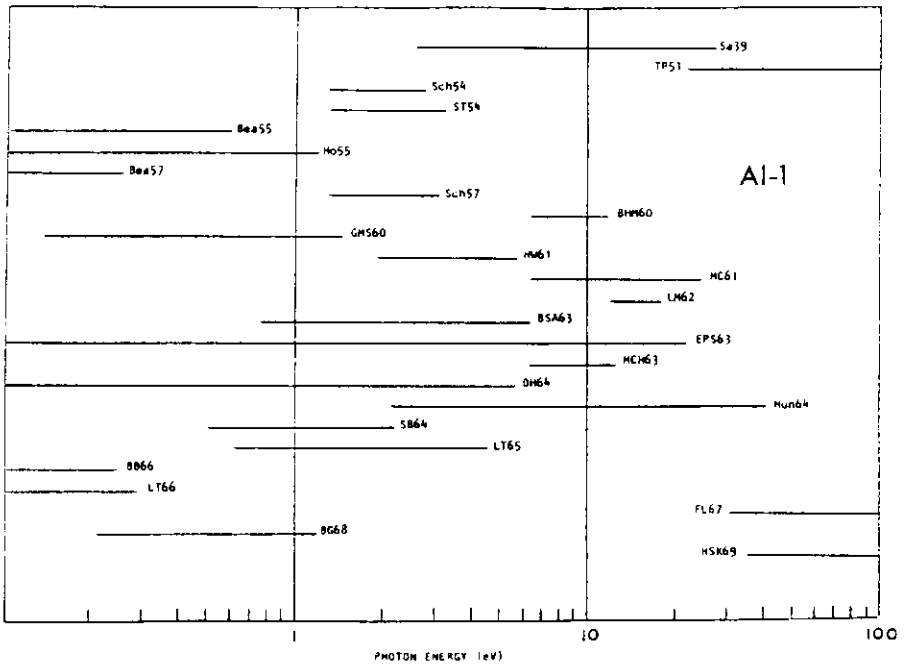

Fig. 17 Survey of available data on Al.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Al-3
				Film	X-tal	Bulk	Prep		
HKS70	~72-210	Trans		x				KK: μ	absorption measurements
LMM71	0.6-2.5	Ellips	198, 298, 404, 552	x			In	σ	uhv films
MM71	0.7-2.5	Ellips	298	x				$\varepsilon_1,\varepsilon_2$	
MaM72	~0.5-2.5	Ellips	140-552	x			In	σ	uhv films
BHM73	0.6-4	Ellips		x				$\sigma, 1-\varepsilon_1, \varepsilon_2$	film formed by evaporation at 25 K onto a previously RT-deposited film
HCN73	1.96	Ellips		x					studied deposition conditions with one photon energy
Hun73	0.7-2.5	Ellips	140, 198	x				ε_1,σ	
BL75	0.2-3	Refl	4.2		x		EP	A; KK: σ	absorptivity measured by calorimetry
HGK75	13-150	Trans		x			Ex	KK: μ	absorption measurements with synchrotron radiation
HGK76	30-150	Trans		x				KK: μ	absorption measurements with synchrotron radiation
HKL77	1.77-2.95	Ellips	1.5, 300	x				$\varepsilon_1,\varepsilon_2$	plotted data is at T = 300 K
RYE77			150-1000					ε_H	emissivity

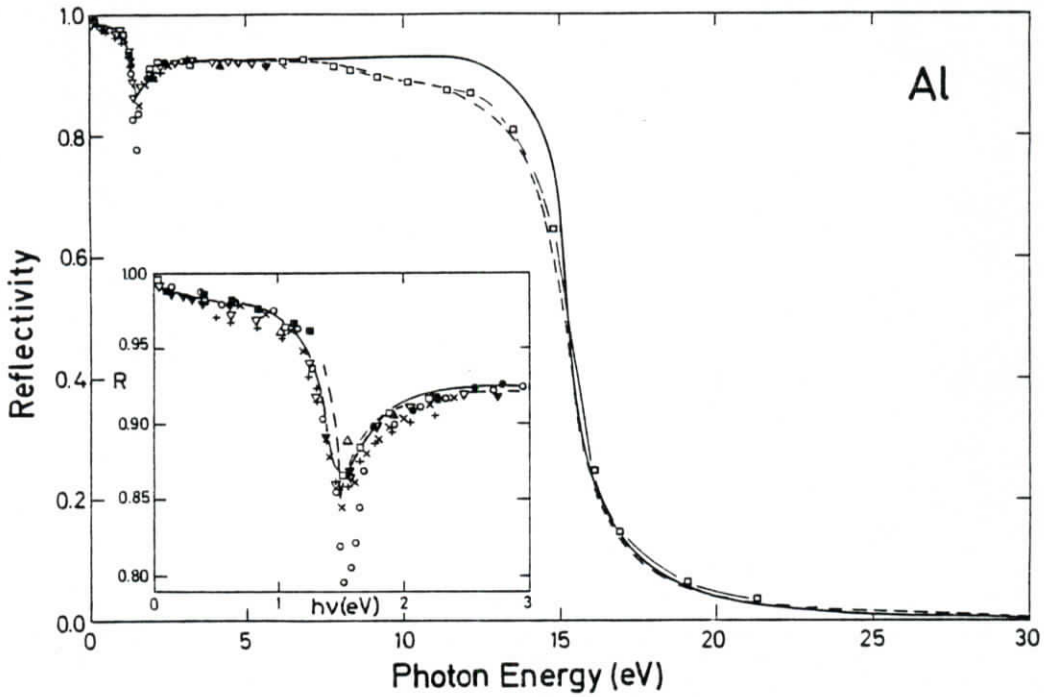

Fig. 18 Reflectivity of Al. Results by SS80 (——); SH64 (+++); DH64 (▽▽▽); MM71 (xxx); HKL77 (●●●); BL70 (ooo); EPS63 (□□□); HW61 (▲▲▲); BG68 (■■■); BB66 (▼▼▼); HGK75 (---); GMS60 (ΔΔΔ).

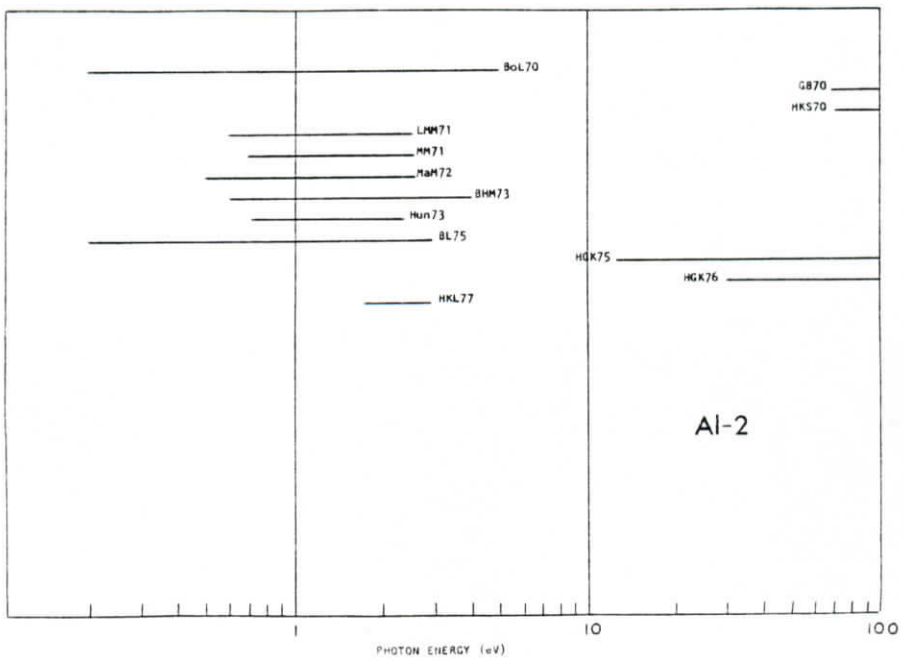

Fig. 17 Survey of available data on Al.

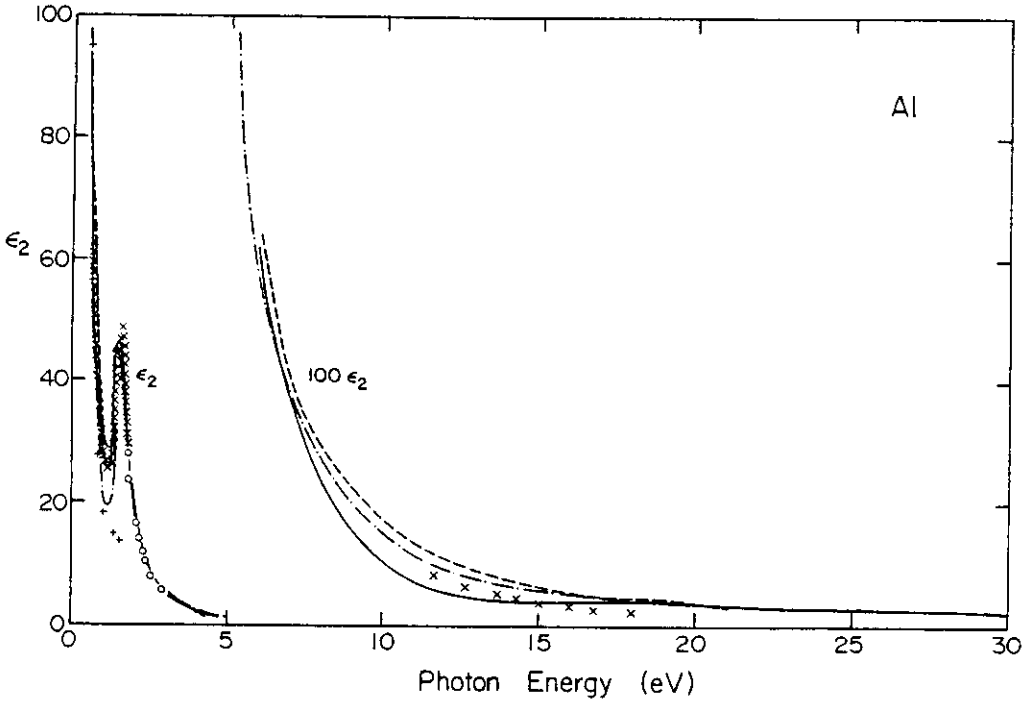

Fig. 20 ϵ_2 for Al. Results by SS80 (——); LM62 (xxx, ~12-18 eV); HGK75 (—·—); EPS63 (---); MM71 (xxx, ~1-3 eV); GMS60 (+++); HKL77 (ooo).

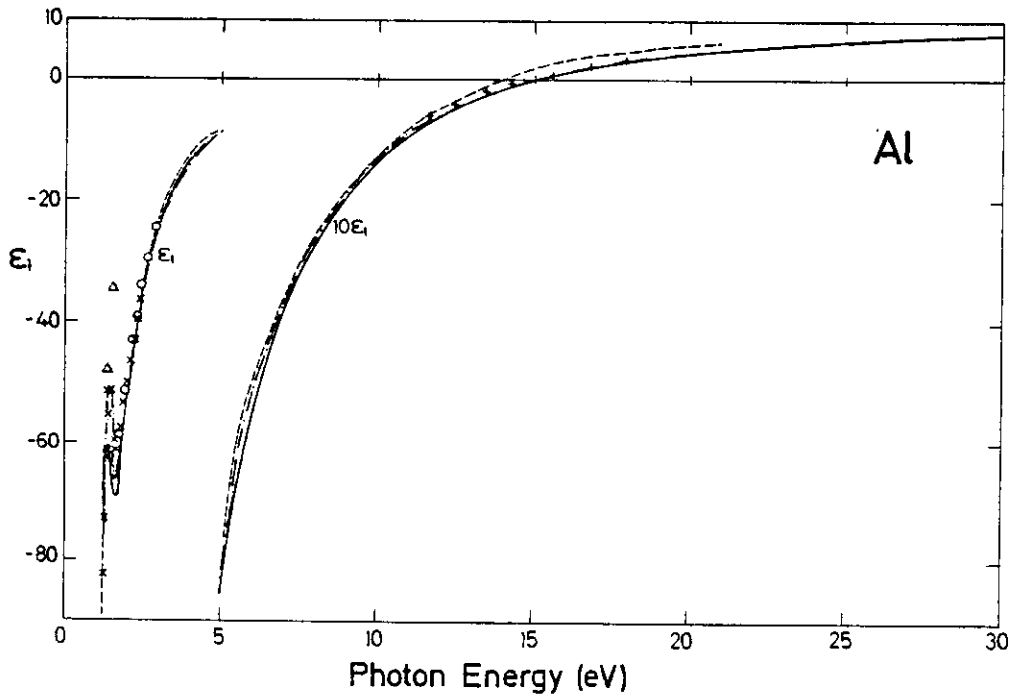

Fig. 19 ϵ_1 for Al. Results by SS80 (——); EPS63 (---); MM71 (xxx); LM62 (+++); HKL71 (ooo); HGK75 (—·—); GMS60 (ΔΔΔ).

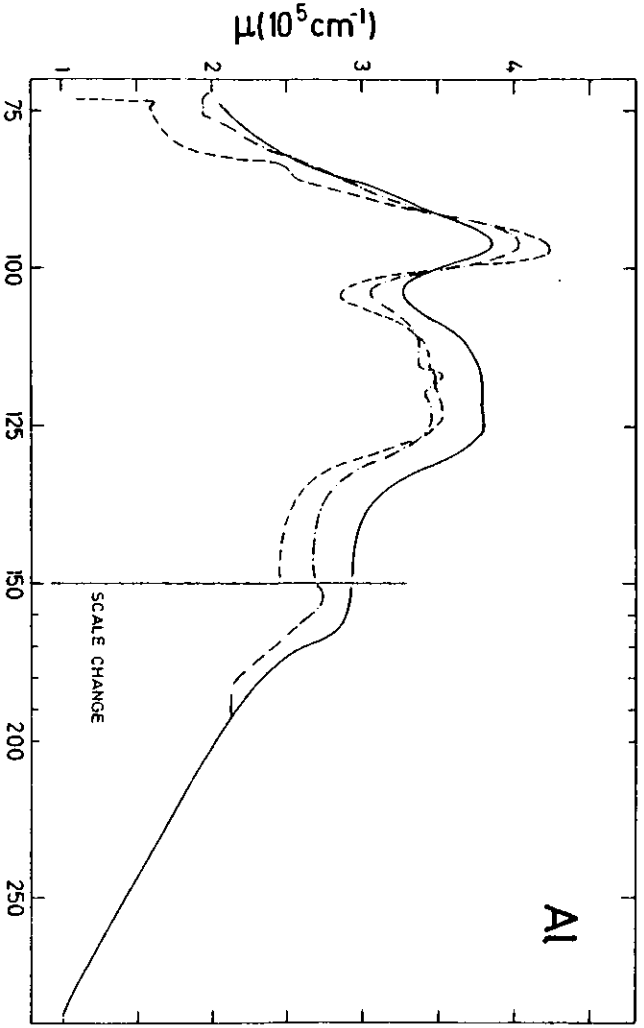

Fig. 21 Absorption coefficient for Al. Results by RSK69 (——); GB70 (—·—); HGK75 (---).

Aluminum

publication by E. Shiles, T. Sasaki, M. Inokuti, and D.Y. Smith in Phys. Rev. B 22, 1612 (1980) based on the following tabulation

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
0.040	-31773.000	40166.000	90.595	203.701	0.000	.9923
0.042	-30076.000	38207.000	92.177	196.399	0.000	.9922
0.044	-28384.000	32981.000	86.975	189.601	0.000	.9920
0.046	-26813.000	30297.000	82.598	183.400	0.000	.9919
0.048	-25374.000	27897.000	78.538	177.801	0.000	.9917
0.050	-24028.000	25829.000	74.997	172.199	0.000	.9915
0.052	-22750.000	23943.000	71.686	167.000	0.000	.9914
0.054	-21370.000	22441.000	69.346	161.800	0.000	.9911
0.056	-20379.000	21223.000	67.246	157.601	0.000	.9909
0.058	-19502.000	20079.000	65.150	154.099	0.000	.9907
0.060	-18790.000	18956.000	62.952	150.799	0.000	.9906
0.062	-17989.000	17856.000	60.852	147.200	0.000	.9905
0.064	-17360.000	16900.000.	58.599	144.201	0.000	.9904
0.066	-16612.000	15962.000	56.683	140.801	0.000	.9902
0.068	-15929.000	15245.000	55.316	137.800	0.000	.9900
0.070	-15467.000	14577.000	53.790	135.500	0.000	.9899
0.072	-14962.000	13839.000	52.027	132.999	0.000	.9898
0.074	-14511.000	13178.000	50.452	130.600	0.000	.9898
0.076	-14072.000	12542.000	48.877	128.300	0.000	.9897
0.078	-13633.000	11934.000	47.357	125.999	0.000	.9896
0.080	-13214.000	11350.000	45.784	123.734	0.000	.9895
0.082	-12817.000	10808.000	44.434	121.620	0.000	.9895
0.084	-12440.000	10296.000	43.391	119.678	0.000	.9893
0.086	-12097.000	9839.297	42.187	117.600	0.000	.9893
0.088	-11808.000	9493.797	40.886	116.102	0.000	.9893
0.090	-11447.000	9048.598	39.651	114.102	0.000	.9892
0.092	-11144.000	8677.297	38.600	112.401	0.000	.9891
0.094	-10880.000	8280.199	37.366	110.798	0.000	.9891
0.096	-10546.000	7891.396	36.233	108.898	0.000	.9891
0.098	-10245.000	7571.000	35.312	107.201	0.000	.9890
0.100	-9963.598	7278.699	34.464	105.600	0.000	.9889
0.105	-9365.297	6574.699	32.229	102.000	0.000	.9888
0.110	-8769.398	5939.898	30.185	98.390	0.000	.9887
0.115	-8263.000	5399.398	28.352	95.220	0.000	.9886
0.120	-7787.199	4898.598	26.576	92.160	0.000	.9885
0.125	-7342.297	4456.199	24.965	89.250	0.000	.9884
0.130	-6930.098	4065.100	23.498	86.500	0.000	.9884
0.135	-6549.699	3719.300	22.162	83.910	0.000	.9883
0.140	-6204.699	3409.800	20.919	81.500	0.000	.9883
0.145	-5889.297	3121.500	19.699	79.230	0.000	.9882
0.150	-5577.898	2858.600	18.572	76.960	0.000	.9882
0.155	-5297.098	2622.600	17.518	74.860	0.000	.9882
0.160	-5015.797	2407.200	16.549	72.730	0.000	.9882
0.165	-4757.598	2221.700	15.763	70.740	0.000	.9881
0.170	-4512.098	2053.800	14.924	68.810	0.000	.9880
0.175	-4275.898	1910.700	14.274	66.930	0.000	.9879
0.180	-4065.100	1791.000	13.731	65.220	0.000	.9877
0.185	-3875.400	1681.900	13.214	63.640	0.000	.9876
0.190	-3702.800	1577.700	12.691	62.160	0.000	.9875

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
0.195	-3535.500	1481.900	12.207	60.700	0.000	.9873
0.200	-3387.100	1393.200	11.733	59.370	0.000	.9873
0.210	-3096.000	1230.900	10.856	56.691	0.000	.9871
0.220	-2845.300	1103.800	10.162	54.301	0.000	.9868
0.230	-2622.200	994.940	9.550	52.090	0.000	.9865
0.240	-2424.300	905.180	9.041	50.060	0.000	.9861
0.250	-2252.900	828.260	8.586	48.235	0.000	.9858
0.260	-2096.300	760.630	8.173	46.531	0.000	.9855
0.270	-1963.500	701.420	7.795	44.992	0.000	.9852
0.280	-1840.900	647.030	7.430	43.544	0.000	.9849
0.290	-1730.900	596.740	7.093	42.204	0.000	.9846
0.300	-1632.000	553.710	6.759	40.960	0.000	.9844
0.310	-1540.000	511.610	6.433	39.767	0.000	.9843
0.320	-1453.900	473.790	6.134	38.620	0.000	.9841
0.330	-1373.800	441.560	5.883	37.529	0.000	.9838
0.340	-1302.300	413.600	5.661	36.529	0.000	.9836
0.350	-1237.700	387.140	5.438	35.599	0.000	.9834
0.360	-1177.600	361.780	5.212	34.710	0.000	.9832
0.370	-1121.600	337.730	4.987	33.860	0.000	.9831
0.380	-1067.800	315.760	4.781	33.025	0.000	.9830
0.390	-1017.600	296.830	4.605	32.230	0.000	.9828
0.400	-971.470	280.450	4.454	31.485	0.000	.9826
0.420	-890.760	249.350	4.138	30.131	0.000	.9823
0.440	-818.880	221.070	3.829	28.871	0.000	.9821
0.460	-754.370	196.500	3.548	27.694	0.000	.9820
0.480	-696.690	175.420	3.297	26.600	0.000	.9818
0.500	-644.950	157.160	3.072	25.581	0.000	.9817
0.520	-598.200	141.400	2.871	24.626	0.000	.9815
0.540	-555.930	128.090	2.699	23.732	0.000	.9813
0.560	-518.300	116.580	2.545	22.908	0.000	.9811
0.580	-484.210	106.160	2.398	22.135	0.000	.9809
0.600	-452.920	97.295	2.273	21.403	0.000	.9806
0.650	-386.350	78.532	1.987	19.756	0.001	.9801
0.700	-332.780	64.879	1.770	18.328	0.001	.9794
0.750	-289.020	54.332	1.591	17.075	0.001	.9787
0.800	-252.480	46.070	1.444	15.955	0.001	.9778
0.850	-221.460	39.819	1.332	14.941	0.001	.9767
0.900	-194.990	35.454	1.264	14.021	0.001	.9749
0.950	-172.780	32.434	1.228	13.202	0.001	.9726
1.000	-153.880	30.208	1.212	12.464	0.001	.9697
1.050	-137.690	28.460	1.206	11.796	0.001	.9665
1.100	-123.570	26.860	1.201	11.181	0.002	.9630
1.150	-110.519	25.665	1.213	10.582	0.002	.9585
1.200	-98.612	25.231	1.260	10.010	0.002	.9521
1.220	-93.974	25.474	1.302	9.781	0.003	.9484
1.240	-89.971	25.923	1.353	9.581	0.003	.9444
1.260	-86.200	26.100	1.390	9.386	0.003	.9407
1.280	-82.271	26.110	1.422	9.181	0.004	.9369
1.300	-77.922	26.278	1.468	8.949	0.004	.9318
1.320	-72.927	27.435	1.579	8.685	0.005	.9230
1.340	-69.012	30.031	1.768	8.493	0.005	.9114
1.360	-66.705	32.535	1.939	8.394	0.006	.9020
1.380	-64.446	34.505	2.080	8.293	0.006	.8937
1.400	-62.425	36.736	2.237	8.212	0.007	.8852
1.420	-61.074	39.263	2.402	8.176	0.007	.8775
1.440	-60.939	41.511	2.529	8.206	0.008	.8732
1.460	-60.706	43.079	2.620	8.220	0.008	.8701

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
1.480	-60.965	44.564	2.697	8.261	0.008	.8683
1.500	-61.503	45.609	2.745	8.309	0.008	.8678
1.520	-62.052	46.386	2.777	8.352	0.008	.8678
1.540	-62.953	47.064	2.797	8.413	0.008	.8687
1.560	-64.308	47.378	2.790	8.491	0.007	.8709
1.580	-66.272	46.672	2.719	8.563	0.007	.8757
1.600	-67.029	45.129	2.625	8.597	0.007	.8794
1.650	-66.525	41.000	2.413	8.622	0.006	.8878
1.700	-66.910	36.742	2.143	8.573	0.006	.8972
1.750	-66.676	31.996	1.908	8.385	0.006	.9031
1.800	-64.292	26.572	1.741	8.205	0.006	.9069
1.900	-58.961	23.279	1.488	7.821	0.006	.9116
2.000	-54.236	19.502	1.304	7.479	0.006	.9148
2.100	-49.655	16.425	1.148	7.154	0.006	.9177
2.200	-45.529	13.944	1.018	6.846	0.006	.9200
2.300	-42.126	11.956	0.912	6.554	0.006	.9217
2.400	-38.792	10.361	0.826	6.283	0.006	.9228
2.500	-35.812	9.111	0.755	6.032	0.007	.9234
2.600	-33.154	8.066	0.695	5.800	0.007	.9238
2.700	-30.777	7.166	0.643	5.585	0.007	.9240
2.800	-28.640	6.440	0.598	5.385	0.007	.9242
2.900	-26.709	5.759	0.558	5.198	0.008	.9242
3.000	-24.967	5.256	0.523	5.024	0.008	.9241
3.200	-21.951	4.327	0.460	4.708	0.009	.9243
3.400	-19.424	3.606	0.407	4.426	0.009	.9245
3.600	-17.288	3.035	0.363	4.174	0.010	.9246
3.800	-15.468	2.575	0.326	3.946	0.010	.9247
4.000	-13.901	2.203	0.294	3.740	0.011	.9248
4.200	-12.545	1.899	0.267	3.552	0.012	.9248
4.400	-11.366	1.647	0.244	3.380	0.012	.9249
4.600	-10.333	1.437	0.223	3.222	0.013	.9249
4.800	-9.423	1.260	0.205	3.076	0.014	.9249
5.000	-8.617	1.120	0.190	2.942	0.015	.9244
6.000	-5.700	0.621	0.130	2.391	0.019	.9257
6.500	-4.711	0.479	0.110	2.173	0.021	.9260
7.000	-3.923	0.375	0.095	1.983	0.024	.9262
7.500	-3.285	0.297	0.082	1.814	0.027	.9265
8.000	-2.762	0.238	0.072	1.663	0.031	.9269
8.500	-2.327	0.192	0.063	1.527	0.035	.9272
9.000	-1.962	0.156	0.056	1.402	0.040	.9277
9.500	-1.651	0.127	0.049	1.286	0.046	.9282
10.000	-1.386	0.104	0.044	1.178	0.054	.9286
10.500	-1.157	0.085	0.040	1.076	0.063	.9293
11.000	-0.956	0.070	0.036	0.979	0.076	.9298
11.500	-0.779	0.058	0.033	0.883	0.096	.9283
12.000	-0.624	0.052	0.033	0.791	0.132	.9224
12.500	-0.489	0.048	0.034	0.700	0.199	.9118
13.000	-0.370	0.046	0.038	0.609	0.330	.8960
13.250	-0.317	0.044	0.039	0.564	0.433	.9877
13.500	-0.266	0.042	0.041	0.517	0.585	.8789
13.750	-0.217	0.041	0.044	0.468	0.841	.8662
14.000	-0.171	0.040	0.046	0.417	1.298	.8486
14.100	-0.154	0.040	0.050	0.395	1.577	.8404
14.200	-0.137	0.039	0.053	0.373	1.948	.8312
14.300	-0.120	0.039	0.055	0.350	2.445	.8213
14.400	-0.103	0.038	0.058	0.327	3.137	.8102

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
14.500	-0.087	0.037	0.062	0.301	4.147	.7977
14.550	-0.079	0.037	0.064	0.287	4.677	.7899
14.600	-0.070	0.036	0.067	0.273	5.795	.7802
14.650	-0.062	0.036	0.070	0.259	6.963	.7699
14.700	-0.054	0.036	0.073	0.243	8.551	.7572
14.750	-0.046	0.036	0.079	0.228	10.652	.7408
14.800	-0.037	0.036	0.086	0.211	13.398	.7202
14.850	-0.029	0.037	0.094	0.195	16.675	.6951
14.900	-0.022	0.038	0.104	0.181	19.931	.6680
14.950	-0.015	0.038	0.114	0.166	22.931	.6400
15.000	-0.008	0.038	0.125	0.153	25.070	.6119
15.050	-0.001	0.038	0.137	0.140	26.103	.5820
15.100	0.006	0.038	0.151	0.128	25.297	.5506
15.150	0.013	0.038	0.164	0.117	23.242	.5201
15.200	0.020	0.038	0.178	0.108	20.367	.4903
15.250	0.027	0.038	0.193	0.100	17.326	.4616
15.300	0.034	0.039	0.207	0.094	14.537	.4348
15.350	0.041	0.039	0.221	0.088	12.180	.4104
15.400	0.048	0.039	0.234	0.084	10.294	.3881
15.450	0.054	0.040	0.247	0.081	8.774	.3681
15.500	0.061	0.040	0.258	0.078	7.594	.3501
15.550	0.067	0.040	0.269	0.075	6.592	.3335
15.600	0.073	0.041	0.280	0.073	5.797	.3182
15.650	0.079	0.041	0.290	0.071	5.162	.3047
15.700	0.085	0.041	0.300	0.069	4.607	.2921
15.750	0.091	0.041	0.309	0.067	4.135	.2803
15.800	0.097	0.042	0.318	0.065	3.741	.2694
15.850	0.103	0.042	0.327	0.064	3.400	.2592
15.900	0.108	0.042	0.335	0.063	3.107	.2498
15.950	0.114	0.042	0.343	0.061	2.844	.2410
16.000	0.119	0.042	0.351	0.060	2.603	.2326
16.100	0.131	0.042	0.366	0.057	2.222	.2170
16.200	0.141	0.041	0.380	0.055	1.911	.2031
16.300	0.152	0.041	0.394	0.052	1.661	.1905
16.400	0.163	0.041	0.407	0.050	1.453	.1789
16.500	0.173	0.041	0.419	0.049	1.286	.1684
16.750	0.199	0.040	0.448	0.045	0.981	.1460
17.000	0.223	0.040	0.471	0.042	0.780	.1278
17.250	0.247	0.040	0.498	0.040	0.638	.1129
17.500	0.269	0.040	0.520	0.038	0.537	.1005
17.750	0.290	0.039	0.540	0.036	0.458	.0899
18.000	0.310	0.039	0.558	0.035	0.397	.0809
18.500	0.348	0.038	0.591	0.032	0.312	.0664
19.000	0.384	0.037	0.620	0.030	0.252	.0554
19.500	0.416	0.037	0.646	0.028	0.211	.0467
20.000	0.446	0.036	0.668	0.027	0.179	.0398
20.500	0.474	0.035	0.689	0.025	0.155	.0342
21.000	0.500	0.034	0.707	0.024	0.136	.0296
21.500	0.524	0.034	0.724	0.023	0.122	.0258
22.000	0.546	0.033	0.739	0.022	0.109	.0226
22.500	0.567	0.032	0.753	0.021	0.100	.0199
23.000	0.587	0.031	0.766	0.021	0.091	.0177
23.500	0.605	0.031	0.778	0.020	0.084	.0157
24.000	0.622	0.030	0.789	0.019	0.077	.0140
24.500	0.638	0.029	0.799	0.018	0.072	.0126
25.000	0.654	0.029	0.809	0.018	0.067	.0113
25.500	0.668	0.028	0.817	0.017	0.063	.0102

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
26.000	0.681	0.027	0.826	0.016	0.058	.0092
26.500	0.694	0.027	0.833	0.016	0.055	.0083
27.000	0.706	0.026	0.840	0.015	0.052	.0076
27.500	0.718	0.025	0.847	0.015	0.049	.0069
28.000	0.728	0.025	0.854	0.014	0.047	.0063
28.500	0.739	0.024	0.859	0.014	0.044	.0058
29.000	0.748	0.023	0.865	0.014	0.042	.0053
29.500	0.758	0.023	0.871	0.013	0.039	.0048
30.000	0.766	0.022	0.876	0.013	0.037	.0044
31.000	0.783	0.021	0.885	0.012	0.033	.0037
32.000	0.799	0.020	0.894	0.011	0.031	.0032
33.000	0.813	0.019	0.902	0.011	0.029	.0027
34.000	0.825	0.019	0.909	0.010	0.027	.0023
35.000	0.837	0.018	0.915	0.010	0.026	.0020
36.000	0.848	0.017	0.921	0.009	0.024	.0017
37.000	0.857	0.017	0.926	0.009	0.023	.0015
38.000	0.867	0.016	0.931	0.009	0.022	.0013
39.000	0.875	0.016	0.935	0.008	0.020	.0011
40.000	0.883	0.015	0.940	0.008	0.020	.0010
41.000	0.890	0.015	0.943	0.008	0.019	.0009
42.000	0.897	0.014	0.947	0.007	0.017	.0008
43.000	0.903	0.014	0.951	0.007	0.017	.0007
44.000	0.910	0.013	0.954	0.007	0.016	.0006
45.000	0.915	0.013	0.957	0.007	0.016	.0005
46.000	0.920	0.013	0.959	0.007	0.015	.0004
47.000	0.925	0.012	0.962	0.006	0.014	.0004
48.000	0.930	0.012	0.964	0.006	0.014	.0003
49.000	0.935	0.012	0.967	0.006	0.013	.0003
50.000	0.939	0.011	0.969	0.006	0.013	.0003
51.000	0.943	0.011	0.971	0.006	0.012	.0002
52.000	0.947	0.010	0.973	0.005	0.012	.0002
53.000	0.951	0.010	0.975	0.005	0.011	.0002
54.000	0.955	0.010	0.977	0.005	0.011	.0001
55.000	0.958	0.010	0.979	0.005	0.011	.0001
56.000	0.962	0.009	0.981	0.005	0.010	.0001
57.000	0.965	0.009	0.982	0.005	0.010	.0001
58.000	0.968	0.009	0.984	0.005	0.010	.0001
59.000	0.971	0.009	0.986	0.005	0.010	.0001
60.000	0.975	0.009	0.987	0.004	0.009	.0000
61.000	0.978	0.009	0.989	0.004	0.009	.0000
62.000	0.981	0.009	0.990	0.004	0.009	.0000
63.000	0.984	0.008	0.992	0.004	0.009	.0000
64.000	0.988	0.008	0.994	0.004	0.008	.0000
65.000	0.991	0.008	0.995	0.004	0.008	.0000
66.000	0.994	0.008	0.997	0.004	0.008	.0000
67.000	0.998	0.007	0.999	0.004	0.007	.0000
68.000	1.002	0.007	1.001	0.004	0.007	.0000
69.000	1.007	0.007	1.003	0.004	0.007	.0000
70.000	1.013	0.007	1.006	0.004	0.007	.0000
70.500	1.016	0.007	1.008	0.004	0.007	.0000
71.000	1.020	0.007	1.010	0.004	0.007	.0000
71.500	1.025	0.007	1.013	0.003	0.007	.0000
72.000	1.033	0.007	1.016	0.003	0.007	.0001
72.100	1.035	0.007	1.017	0.003	0.006	.0001
72.200	1.037	0.007	1.018	0.003	0.006	.0001
72.300	1.040	0.007	1.020	0.003	0.006	.0001
72.400	1.044	0.007	1.022	0.003	0.006	.0001

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
72.500	1.050	0.047	1.025	0.004	0.047	.0002
72.600	1.061	0.046	1.030	0.004	0.047	.0002
72.700	1.069	0.025	1.034	0.012	0.027	.0003
72.800	1.061	0.041	1.030	0.020	0.037	.0003
72.900	1.051	0.041	1.025	0.020	0.037	.0003
73.000	1.049	0.035	1.024	0.019	0.035	.0002
73.100	1.052	0.040	1.026	0.020	0.036	.0003
73.200	1.050	0.049	1.025	0.024	0.045	.0003
73.300	1.043	0.053	1.022	0.026	0.049	.0003
73.400	1.038	0.052	1.019	0.025	0.048	.0002
73.500	1.035	0.051	1.018	0.025	0.047	.0002
73.600	1.033	0.050	1.017	0.024	0.047	.0002
73.700	1.032	0.049	1.016	0.024	0.046	.0002
73.800	1.031	0.049	1.016	0.024	0.046	.0002
73.900	1.030	0.049	1.015	0.024	0.046	.0002
74.000	1.029	0.049	1.015	0.024	0.046	.0002
74.500	1.025	0.049	1.013	0.024	0.047	.0002
75.000	1.022	0.049	1.011	0.024	0.046	.0002
75.500	1.020	0.048	1.010	0.024	0.046	.0002
76.000	1.020	0.046	1.010	0.024	0.046	.0002
76.500	1.019	0.049	1.010	0.024	0.047	.0002
77.000	1.018	0.051	1.009	0.025	0.049	.0002
77.500	1.015	0.051	1.008	0.025	0.049	.0002
78.000	1.014	0.050	1.007	0.025	0.048	.0002
79.000	1.013	0.049	1.007	0.024	0.048	.0002
80.000	1.013	0.049	1.007	0.024	0.048	.0002
81.000	1.014	0.050	1.007	0.025	0.049	.0002
82.000	1.014	0.051	1.007	0.025	0.050	.0002
83.000	1.013	0.053	1.007	0.026	0.051	.0002
84.000	1.013	0.054	1.007	0.027	0.052	.0002
85.000	1.012	0.056	1.007	0.028	0.054	.0002
86.000	1.011	0.057	1.006	0.028	0.055	.0002
87.000	1.010	0.057	1.005	0.029	0.056	.0002
88.000	1.010	0.058	1.005	0.029	0.057	.0002
89.000	1.010	0.059	1.006	0.029	0.058	.0002
90.000	1.010	0.062	1.005	0.031	0.061	.0002
91.000	1.009	0.064	1.005	0.032	0.063	.0003
92.000	1.007	0.067	1.004	0.033	0.066	.0003
93.000	1.004	0.069	1.002	0.035	0.068	.0003
94.000	1.000	0.071	1.000	0.035	0.070	.0003
95.000	0.996	0.071	0.999	0.036	0.071	.0003
96.000	0.992	0.072	0.996	0.036	0.072	.0003
97.000	0.986	0.069	0.994	0.035	0.071	.0003
98.000	0.983	0.065	0.992	0.033	0.067	.0003
99.000	0.982	0.062	0.991	0.031	0.064	.0003
100.000	0.980	0.059	0.991	0.030	0.061	.0002
101.000	0.980	0.056	0.990	0.028	0.058	.0002
102.000	0.980	0.052	0.990	0.026	0.054	.0002
103.000	0.982	0.049	0.992	0.025	0.051	.0002
104.000	0.985	0.049	0.993	0.024	0.050	.0002
105.000	0.987	0.049	0.994	0.024	0.050	.0002
106.000	0.987	0.049	0.994	0.024	0.050	.0002
107.000	0.988	0.049	0.994	0.025	0.050	.0002
108.000	0.988	0.050	0.994	0.025	0.051	.0002
109.000	0.988	0.050	0.994	0.025	0.051	.0002
110.000	0.987	0.051	0.994	0.025	0.052	.0002
111.000	0.987	0.051	0.994	0.025	0.052	.0002

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
112.000	0.986	0.051	0.993	0.025	0.052	.0002
113.000	0.985	0.050	0.993	0.025	0.052	.0002
114.000	0.984	0.050	0.993	0.025	0.051	.0002
115.000	0.984	0.049	0.992	0.025	0.051	.0002
116.000	0.984	0.049	0.992	0.025	0.051	.0002
117.000	0.983	0.049	0.992	0.025	0.050	.0002
118.000	0.983	0.049	0.992	0.025	0.051	.0002
119.000	0.982	0.049	0.991	0.024	0.050	.0002
120.000	0.981	0.048	0.991	0.024	0.049	.0002
122.000	0.981	0.047	0.991	0.024	0.049	.0002
124.000	0.979	0.047	0.990	0.024	0.049	.0002
126.000	0.977	0.046	0.989	0.023	0.048	.0002
128.000	0.975	0.043	0.988	0.022	0.045	.0002
130.000	0.975	0.041	0.987	0.021	0.043	.0001
132.000	0.975	0.038	0.987	0.019	0.040	.0001
134.000	0.975	0.036	0.988	0.018	0.038	.0001
136.000	0.976	0.035	0.988	0.018	0.036	.0001
138.000	0.976	0.033	0.988	0.017	0.035	.0001
140.000	0.977	0.032	0.989	0.016	0.034	.0001
142.000	0.978	0.032	0.989	0.016	0.033	.0001
144.000	0.978	0.031	0.989	0.016	0.032	.0001
146.000	0.978	0.030	0.989	0.015	0.032	.0001
148.000	0.979	0.030	0.989	0.015	0.031	.0001
150.000	0.979	0.029	0.990	0.015	0.030	.0001
152.000	0.979	0.029	0.990	0.015	0.030	.0001
154.000	0.979	0.029	0.990	0.014	0.030	.0001
156.000	0.979	0.028	0.990	0.014	0.029	.0001
158.000	0.979	0.028	0.989	0.014	0.029	.0001
160.000	0.979	0.027	0.989	0.014	0.028	.0001
162.000	0.978	0.027	0.989	0.014	0.028	.0001
164.000	0.978	0.026	0.989	0.013	0.027	.0001
166.000	0.977	0.026	0.989	0.013	0.026	.0001
168.000	0.977	0.023	0.988	0.012	0.024	.0001
170.000	0.978	0.022	0.989	0.011	0.023	.0001
172.000	0.978	0.021	0.989	0.011	0.022	.0001
174.000	0.979	0.020	0.989	0.010	0.021	.0001
176.000	0.979	0.020	0.990	0.010	0.021	.0001
178.000	0.980	0.020	0.990	0.010	0.021	.0001
180.000	0.980	0.019	0.990	0.010	0.020	.0000
185.000	0.980	0.018	0.990	0.009	0.019	.0000
190.000	0.981	0.017	0.990	0.009	0.017	.0000
195.000	0.982	0.016	0.991	0.008	0.016	.0000
200.000	0.982	0.015	0.991	0.007	0.015	.0000
210.000	0.983	0.013	0.992	0.007	0.014	.0000
220.000	0.984	0.012	0.992	0.006	0.012	.0000
230.000	0.985	0.010	0.992	0.005	0.011	.0000
240.000	0.985	0.009	0.993	0.005	0.010	.0000
250.000	0.986	0.008	0.993	0.004	0.009	.0000
260.000	0.987	0.007	0.993	0.004	0.008	.0000
270.000	0.988	0.007	0.994	0.003	0.007	.0000
280.000	0.988	0.006	0.994	0.003	0.006	.0000
290.000	0.989	0.005	0.994	0.003	0.005	.0000
300.000	0.990	0.005	0.995	0.002	0.005	.0000
310.000	0.990	0.004	0.995	0.002	0.004	.0000
320.000	0.991	0.004	0.996	0.002	0.004	.0000
330.000	0.991	0.004	0.996	0.002	0.004	.0000
340.000	0.992	0.003	0.996	0.002	0.003	.0000

Al

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(φ=0)
350.000	0.992	0.003	0.996	0.002	0.003	.0000
360.000	0.992	0.003	0.996	0.001	0.003	.0000
370.000	0.993	0.002	0.996	0.001	0.003	.0000
380.000	0.993	0.002	0.997	0.001	0.002	.0000
390.000	0.993	0.002	0.997	0.001	0.002	.0000
400.000	0.994	0.002	0.997	0.001	0.002	.0000
410.000	0.994	0.002	0.997	0.001	0.002	.0000
420.000	0.994	0.002	0.997	0.001	0.002	.0000
430.000	0.995	0.001	0.997	0.001	0.001	.0000
440.000	0.995	0.001	0.997	0.001	0.001	.0000
450.000	0.995	0.001	0.998	0.001	0.001	.0000
460.000	0.996	0.001	0.998	0.001	0.001	.0000
470.000	0.996	0.001	0.998	0.000	0.001	.0000
480.000	0.996	0.001	0.998	0.000	0.001	.0000
490.000	0.996	0.001	0.998	0.000	0.001	.0000
500.000	0.996	0.001	0.998	0.000	0.001	.0000
510.000	0.996	0.001	0.998	0.000	0.001	.0000
520.000	0.996	0.001	0.998	0.000	0.001	.0000
530.000	0.997	0.001	0.998	0.000	0.001	.0000
540.000	0.997	0.001	0.998	0.000	0.001	.0000
550.000	0.997	0.001	0.998	0.000	0.001	.0000
560.000	0.997	0.001	0.998	0.000	0.001	.0000
570.000	0.997	0.000	0.998	0.000	0.000	.0000
580.000	0.997	0.000	0.998	0.000	0.000	.0000
590.000	0.997	0.000	0.998	0.000	0.000	.0000
600.000	0.997	0.000	0.998	0.000	0.000	.0000
610.000	0.997	0.000	0.998	0.000	0.000	.0000
620.000	0.997	0.000	0.998	0.000	0.000	.0000
630.000	0.998	0.000	0.998	0.000	0.000	.0000
640.000	0.998	0.000	0.998	0.000	0.000	.0000
650.000	0.998	0.000	0.998	0.000	0.000	.0000
660.000	0.998	0.000	0.998	0.000	0.000	.0000
670.000	0.998	0.000	0.998	0.000	0.000	.0000
680.000	0.998	0.000	0.998	0.000	0.000	.0000
690.000	0.998	0.000	0.998	0.000	0.000	.0000
700.000	0.998	0.000	0.998	0.000	0.000	.0000
710.000	0.998	0.000	0.998	0.000	0.000	.0000
720.000	0.998	0.000	0.998	0.000	0.000	.0000
730.000	0.998	0.000	0.998	0.000	0.000	.0000
740.000	0.998	0.000	0.998	0.000	0.000	.0000
750.000	0.998	0.000	0.998	0.000	0.000	.0000
760.000	0.998	0.000	0.998	0.000	0.000	.0000
770.000	0.998	0.000	0.998	0.000	0.000	.0000
780.000	0.998	0.000	0.998	0.000	0.000	.0000
790.000	0.998	0.000	0.998	0.000	0.000	.0000
800.000	0.998	0.000	0.998	0.000	0.000	.0000
810.000	0.998	0.000	0.998	0.000	0.000	.0000
820.000	0.998	0.000	0.998	0.000	0.000	.0000
830.000	0.999	0.000	0.998	0.000	0.000	.0000
840.000	0.999	0.000	0.998	0.000	0.000	.0000
850.000	0.999	0.000	0.999	0.000	0.000	.0000
860.000	0.999	0.000	0.999	0.000	0.000	.0000
870.000	0.999	0.000	0.999	0.000	0.000	.0000
880.000	0.999	0.000	0.999	0.000	0.000	.0000
890.000	0.999	0.000	0.999	0.000	0.000	.0000
900.000	0.999	0.000	0.999	0.000	0.000	.0000
910.000	0.999	0.000	0.999	0.000	0.000	.0000
920.000	0.999	0.000	0.999	0.000	0.000	.0000
930.000	0.999	0.000	0.999	0.000	0.000	.0000
940.000	0.999	0.000	0.999	0.000	0.000	.0000
950.000	0.999	0.000	0.999	0.000	0.000	.0000
960.000	0.999	0.000	0.999	0.000	0.000	.0000
970.000	0.999	0.000	0.999	0.000	0.000	.0000
980.000	0.999	0.000	0.999	0.000	0.000	.0000
990.000	0.999	0.000	0.999	0.000	0.000	.0000
1000.000	0.999	0.000	0.999	0.000	0.000	.0000
1049.999	0.999	0.000	1.000	0.000	0.000	.0000
1099.999	0.999	0.000	1.000	0.000	0.000	.0000
1149.999	0.999	0.000	1.000	0.000	0.000	.0000
1199.999	0.999	0.000	1.000	0.000	0.000	.0000
1250.000	0.999	0.000	1.000	0.000	0.000	.0000
1299.999	0.999	0.000	1.000	0.000	0.000	.0000
1349.999	0.999	0.000	1.000	0.000	0.000	.0000
1400.000	1.000	0.000	1.000	0.000	0.000	.0000
1450.000	1.000	0.000	1.000	0.000	0.000	.0000
1499.999	1.000	0.000	1.000	0.000	0.000	.0000
1509.999	1.000	0.000	1.000	0.000	0.000	.0000
1519.999	1.000	0.000	1.000	0.000	0.000	.0000
1530.000	1.000	0.000	1.000	0.000	0.000	.0000
1539.999	1.000	0.000	1.000	0.000	0.000	.0000
1541.999	1.000	0.000	1.000	0.000	0.000	.0000
1543.000	1.000	0.000	1.000	0.000	0.000	.0000
1545.999	1.000	0.000	1.000	0.000	0.000	.0000
1547.999	1.000	0.000	1.000	0.000	0.000	.0000
1548.999	1.000	0.000	1.000	0.000	0.000	.0000
1549.999	1.000	0.000	1.000	0.000	0.000	.0000
1551.000	1.000	0.000	1.000	0.000	0.000	.0000

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample: Film	Sample: X-tal	Sample: Bulk	Sample: Prep	Data Presentation	Remarks
BCF75	~0-~60			x				Im(ε⁻¹): KK: ε1,ε2,μ	energy loss spectroscopy
We077	0.2-5	Refl	4.2		x	x	EP	A; KK: σ	absorption measured by calorimetry
CGW80	2-160	Trans		x				μ	electron energy loss spectroscopy
OTM80	0-60	Trans			x			Im(ε⁻¹)	energy loss spectroscopy

Sc

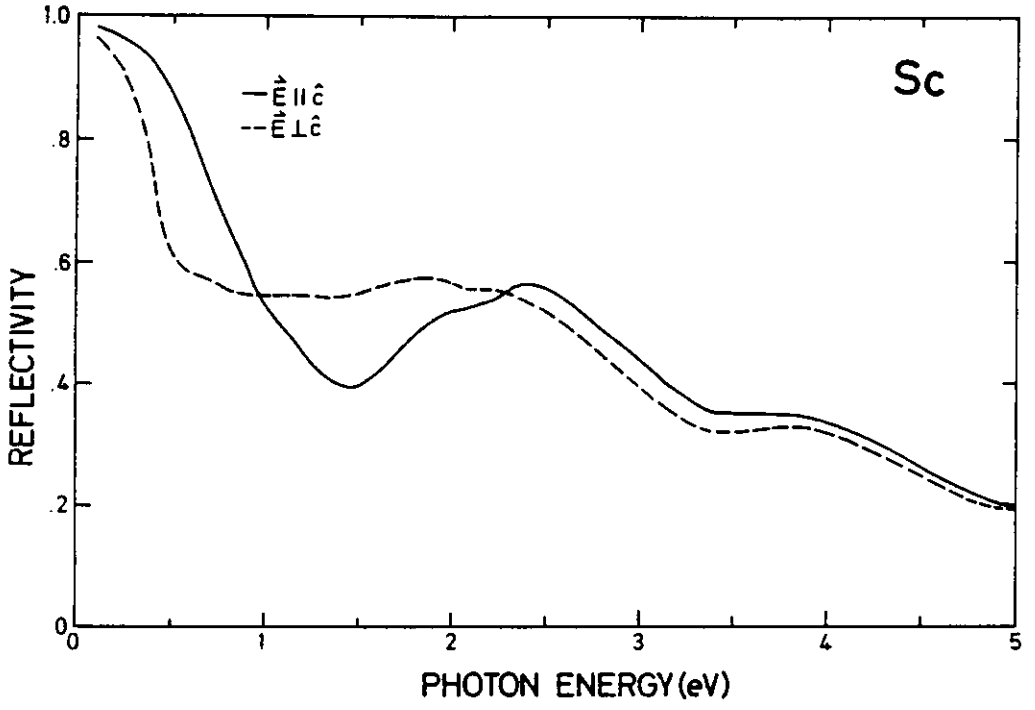

Fig. 23 Reflectivity for Sc. Single crystal results by W077 for $\vec{E} \parallel \hat{c}$ (——) and $\vec{E} \perp \hat{c}$ (---).

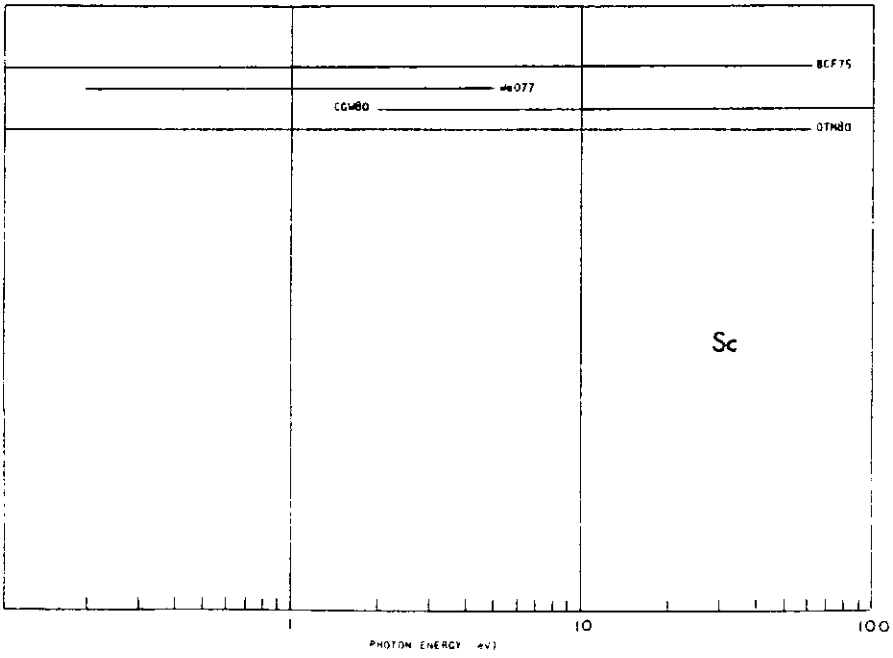

Fig. 22 Survey of available data on Sc.

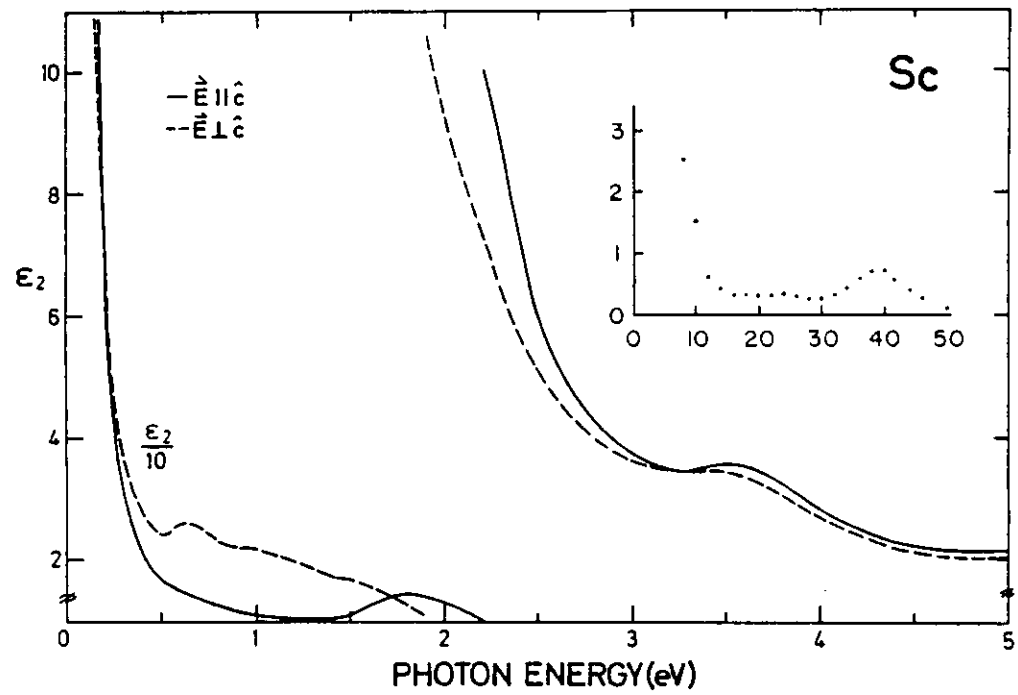

Fig. 25 ε_2 for Sc. Single crystal results by W077 for $\vec{E}\parallel\hat{c}$ (——) and $\vec{E}\perp\hat{c}$ (---); polycrystalline results by CGW80 (···) derived from electron energy loss measurements.

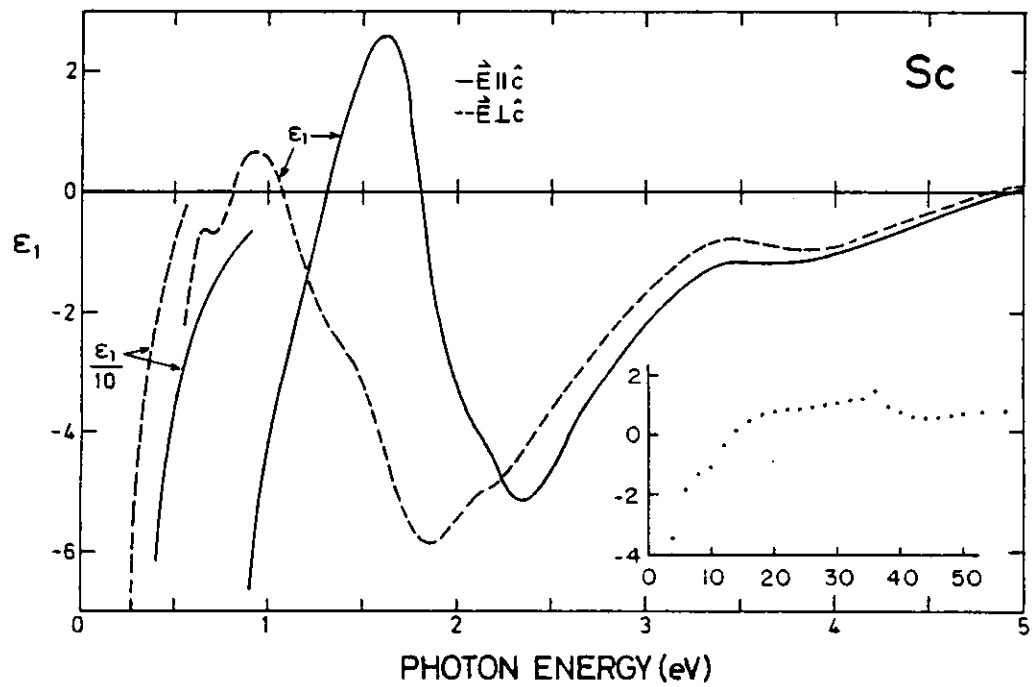

Fig. 24 ε_1 for Sc. Single crystal results by W077 for $\vec{E}\parallel\hat{c}$ (——) and $\vec{E}\perp\hat{c}$ (---); polycrystalline results by CGW80 (···) derived from electron energy loss measurements.

Scandium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and C.G. Olson in Phys. Rev. B 16, 731 (1977)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-1001.53	323.54	5.05	32.05	0.00	.981
0.15	-662.05	145.66	3.32	20.01	0.00	.974
0.20	-499.86	135.05	3.08	21.90	0.00	.975
0.25	-351.49	98.02	2.59	18.93	0.00	.977
0.30	-272.07	71.36	2.14	16.63	0.00	.978
0.35	-173.00	44.62	1.64	13.26	0.00	.984
0.40	-117.34	31.25	1.43	10.93	0.00	.988
0.45	-83.59	24.44	1.32	9.24	0.00	.992
0.50	-61.42	20.33	1.28	7.94	0.00	.995
0.55	-46.24	18.40	1.33	6.93	0.01	.998
0.60	-35.37	16.69	1.36	6.14	0.01	.874
0.65	-26.13	15.77	1.43	5.49	0.02	.841
0.70	-22.59	14.85	1.49	4.98	0.02	.808
0.75	-16.24	14.10	1.55	4.54	0.03	.771
0.80	-14.97	13.52	1.62	4.18	0.03	.734
0.85	-12.31	12.84	1.66	3.88	0.04	.700
0.90	-10.15	12.22	1.69	3.61	0.05	.666
0.95	-8.13	11.77	1.76	3.35	0.06	.627
1.00	-6.64	11.36	1.81	3.15	0.07	.593
1.05	-5.23	11.06	1.87	2.95	0.07	.559
1.10	-3.98	10.95	1.96	2.80	0.08	.527
1.15	-3.23	10.88	2.02	2.70	0.08	.508
1.20	-2.57	10.85	2.05	2.66	0.09	.490
1.25	-1.95	10.59	2.08	2.50	0.09	.472
1.30	-1.33	10.12	2.11	2.40	0.10	.454
1.35	-0.86	9.89	2.15	2.30	0.10	.435
1.40	-0.02	9.78	2.21	2.21	0.10	.419
1.45	0.65	9.74	2.28	2.13	0.10	.404
1.50	1.29	9.90	2.37	2.08	0.10	.396
1.55	1.84	10.20	2.47	2.07	0.09	.394
1.60	2.27	10.64	2.56	2.08	0.09	.397
1.65	2.53	11.24	2.65	2.12	0.08	.405
1.70	2.62	11.97	2.73	2.19	0.08	.417
1.75	2.33	12.78	2.77	2.31	0.08	.433
1.80	1.76	13.44	2.77	2.43	0.07	.449
1.85	0.88	13.94	2.72	2.56	0.07	.465
1.90	-0.07	14.07	2.64	2.66	0.07	.480
1.95	-1.12	13.96	2.54	2.75	0.07	.494
2.00	-2.01	13.51	2.41	2.80	0.07	.505
2.05	-2.67	12.94	2.30	2.82	0.07	.512
2.09	-3.20	12.36	2.19	2.83	0.08	.518
2.05	-3.64	11.76	2.08	2.82	0.08	.523
2.10	-3.98	11.15	1.99	2.81	0.08	.528
2.15	-4.23	10.59	1.89	2.80	0.08	.533
2.20	-4.51	10.05	1.80	2.79	0.08	.538
2.25	-4.81	9.45	1.70	2.78	0.09	.543
2.30	-5.07	8.73	1.59	2.75	0.09	.550
2.35	-5.13	7.95	1.47	2.70	0.09	.561
2.40	-5.05	7.21	1.37	2.63	0.09	.563

Sc $\vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
2.45	-4.84	6.57	1.29	2.55	0.10	.551
2.50	-4.59	5.99	1.22	2.46	0.11	.557
2.60	-3.93	5.18	1.13	2.29	0.12	.536
2.70	-3.10	4.64	1.09	2.14	0.14	.514
2.80	-2.98	4.24	1.05	2.01	0.15	.490
2.90	-2.51	3.95	1.04	1.90	0.16	.468
3.00	-2.15	3.74	1.04	1.80	0.20	.448
3.10	-1.84	3.56	1.04	1.71	0.22	.413
3.20	-1.55	3.45	1.06	1.63	0.24	.387
3.30	-1.30	3.41	1.09	1.57	0.26	.364
3.40	-1.15	3.42	1.11	1.54	0.26	.351
3.50	-1.13	3.41	1.11	1.54	0.26	.349
3.60	-1.14	3.32	1.09	1.52	0.27	.344
3.70	-1.15	3.19	1.06	1.51	0.28	.339
3.80	-1.13	3.02	1.02	1.48	0.29	.347
3.90	-1.08	2.84	0.99	1.43	0.31	.342
4.00	-1.00	2.66	0.96	1.38	0.33	.333
4.10	-0.89	2.51	0.94	1.33	0.35	.321
4.20	-0.79	2.38	0.93	1.28	0.38	.309
4.30	-0.68	2.26	0.92	1.23	0.41	.294
4.40	-0.55	2.16	0.92	1.18	0.44	.276
4.50	-0.42	2.09	0.92	1.13	0.46	.257
4.60	-0.31	2.04	0.94	1.09	0.48	.241
4.70	-0.21	2.00	0.95	1.05	0.49	.226
4.80	-0.10	1.98	0.97	1.02	0.50	.212
4.90	-0.02	1.99	0.99	1.00	0.50	.202
5.00	0.03	2.00	1.01	0.99	0.50	.196

Scandium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and C.G. Olson in Phys. Rev. B 16, 731 (1977)
Based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
0.10	-514.10	234.48	5.05	23.23	0.00	.905
0.13	-335.99	150.24	4.02	19.76	0.00	.957
0.15	-234.71	103.08	3.49	15.71	0.00	.946
0.17	-171.33	82.64	3.06	13.52	0.00	.939
0.20	-130.54	64.35	2.74	11.75	0.00	.935
0.25	-79.08	46.91	2.54	9.25	0.01	.896
0.30	-50.99	36.89	2.44	7.55	0.01	.854
0.35	-33.31	31.31	2.49	6.29	0.01	.807
0.40	-22.01	27.35	2.58	5.34	0.02	.752
0.45	-13.41	24.82	2.72	4.56	0.03	.696
0.50	-6.14	24.01	3.05	3.93	0.04	.617
0.55	-2.21	24.80	3.37	3.69	0.04	.587
0.60	-0.82	25.68	3.54	3.65	0.04	.583
0.65	-0.65	25.91	3.56	3.64	0.04	.582
0.70	-0.77	25.97	3.49	3.60	0.04	.578
0.75	-0.95	25.81	3.42	3.48	0.04	.568
0.80	-0.18	22.85	3.39	3.37	0.04	.557
0.85	0.51	22.38	3.39	3.31	0.04	.551
0.90	0.69	21.94	3.37	3.26	0.05	.547
0.95	0.64	21.67	3.34	3.24	0.05	.545
1.00	0.47	21.36	3.30	3.23	0.05	.544
1.05	0.08	21.06	3.25	3.24	0.05	.545
1.10	-0.42	20.85	3.19	3.25	0.05	.546
1.15	-0.80	20.12	3.11	3.24	0.05	.546
1.20	-1.37	19.58	3.02	3.24	0.05	.547
1.25	-1.84	18.91	2.93	3.23	0.05	.547
1.30	-2.13	18.19	2.84	3.20	0.05	.545
1.35	-2.38	17.50	2.76	3.16	0.06	.543
1.40	-2.11	17.01	2.74	3.10	0.06	.538
1.45	-2.72	17.02	2.69	3.16	0.06	.534
1.50	-3.19	16.52	2.61	3.16	0.06	.547
1.55	-3.67	16.04	2.53	3.17	0.06	.551
1.60	-4.20	15.51	2.44	3.18	0.06	.556
1.65	-4.76	14.85	2.33	3.19	0.06	.562
1.70	-5.22	14.05	2.21	3.18	0.06	.567
1.75	-5.67	13.17	2.09	3.15	0.06	.571
1.80	-5.74	12.24	1.99	3.11	0.07	.573
1.85	-5.82	11.41	1.97	3.05	0.07	.574
1.90	-5.77	10.58	1.77	2.98	0.07	.573
1.95	-5.62	9.84	1.69	2.91	0.08	.570
2.00	-5.40	9.21	1.62	2.84	0.08	.565
2.05	-5.19	8.70	1.57	2.77	0.08	.560
2.10	-5.03	8.26	1.52	2.71	0.09	.556
2.15	-4.94	7.84	1.47	2.66	0.09	.555
2.20	-4.86	7.46	1.41	2.62	0.09	.555
2.25	-4.71	6.86	1.34	2.55	0.10	.551
2.30	-4.59	6.42	1.29	2.48	0.10	.549
2.35	-4.29	6.01	1.24	2.42	0.11	.542
2.40	-4.04	5.66	1.21	2.34	0.12	.534

Sc $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
2.45	-3.81	5.34	1.17	2.29	0.12	.525
2.50	-3.57	5.05	1.14	2.21	0.13	.517
2.55	-3.09	4.50	1.11	2.08	0.15	.499
2.60	-2.85	4.26	1.09	1.95	0.17	.489
2.65	-2.27	4.04	1.08	1.85	0.19	.484
2.90	-1.92	3.79	1.09	1.76	0.21	.487
3.00	-1.62	3.63	1.09	1.67	0.23	.494
3.10	-1.34	3.52	1.10	1.60	0.25	.507
3.20	-1.03	3.45	1.13	1.53	0.26	.545
3.30	-0.84	3.47	1.16	1.49	0.27	.526
3.40	-0.76	3.52	1.19	1.48	0.27	.514
3.50	-0.77	3.54	1.19	1.49	0.27	.521
3.60	-0.84	3.46	1.17	1.49	0.27	.524
3.70	-0.90	3.36	1.13	1.49	0.28	.527
3.80	-0.92	3.19	1.10	1.46	0.29	.527
3.90	-0.92	3.00	1.05	1.42	0.30	.525
4.00	-0.87	2.80	1.02	1.38	0.33	.519
4.10	-0.76	2.63	1.00	1.32	0.35	.505
4.20	-0.67	2.49	0.98	1.27	0.37	.493
4.30	-0.55	2.37	0.97	1.22	0.40	.477
4.40	-0.43	2.27	0.97	1.17	0.43	.461
4.50	-0.33	2.19	0.97	1.13	0.45	.446
4.60	-0.20	2.12	0.98	1.08	0.47	.429
4.70	-0.04	2.09	1.00	1.04	0.49	.413
4.80	0.03	2.09	1.03	1.01	0.48	.400
4.90	0.10	2.10	1.05	1.00	0.47	.393
5.00	0.17	2.12	1.07	0.99	0.47	.387

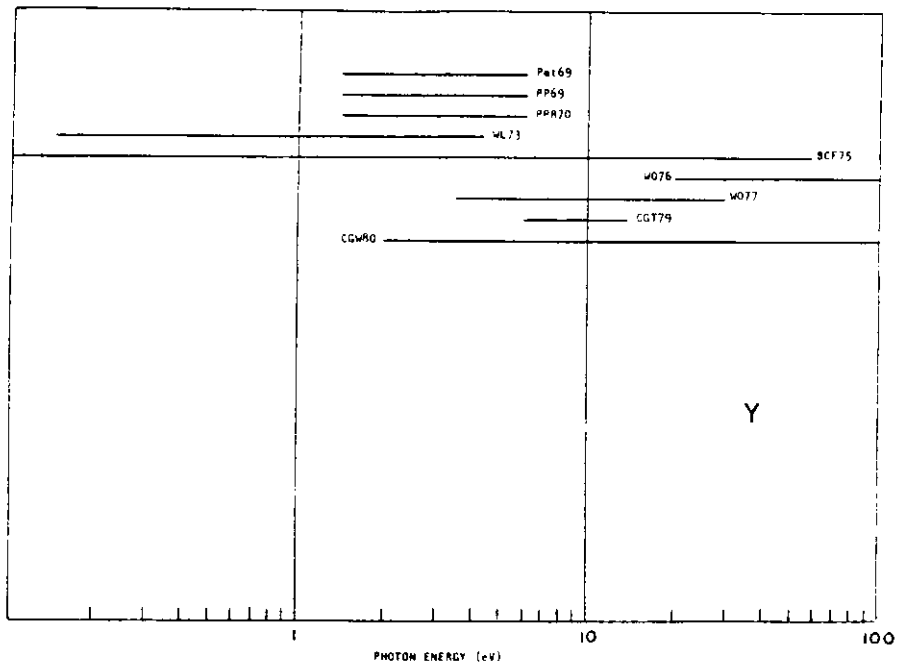

Fig. 26 Survey of available data on Y.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Y
Pet69	1.5-6.2	Trans		x				T	
PP69	1.5-6.2	Trans		x				T	
PPR70	1.5-6.2	Trans		x				T,σ	
WL73	0.15-4.4	Refl	4.2		x		EP	A for E⊥c and E∥c	absorption measured by calorimetry; determined optical anisotropy
BCF75	∿0.01-60			x				$Im(\varepsilon^{-1})$; KK: $\varepsilon_1,\varepsilon_2,\mu$	energy loss spectroscopy
BKB76	1.92		>1000			x		ε_N	emissivity
W076	20-250	Trans		x				μ	optical absorption measurements
W077	3.5-30	Refl			x		EP	R; KK: $\varepsilon_1,\varepsilon_2,\sigma$, $Im(\varepsilon^{-1})$, $Im(\varepsilon+1)^{-1}$	determined optical anisotropy
CGT79	6-14	m-θ		x			In	R,n,k,$\varepsilon_1,\varepsilon_2$, $Im(\varepsilon^{-1})$, $Im(\varepsilon+1)^{-1}$	
CGW80	2-160			x				$Im(\varepsilon^{-1})$	fast electron energy loss spectroscopy

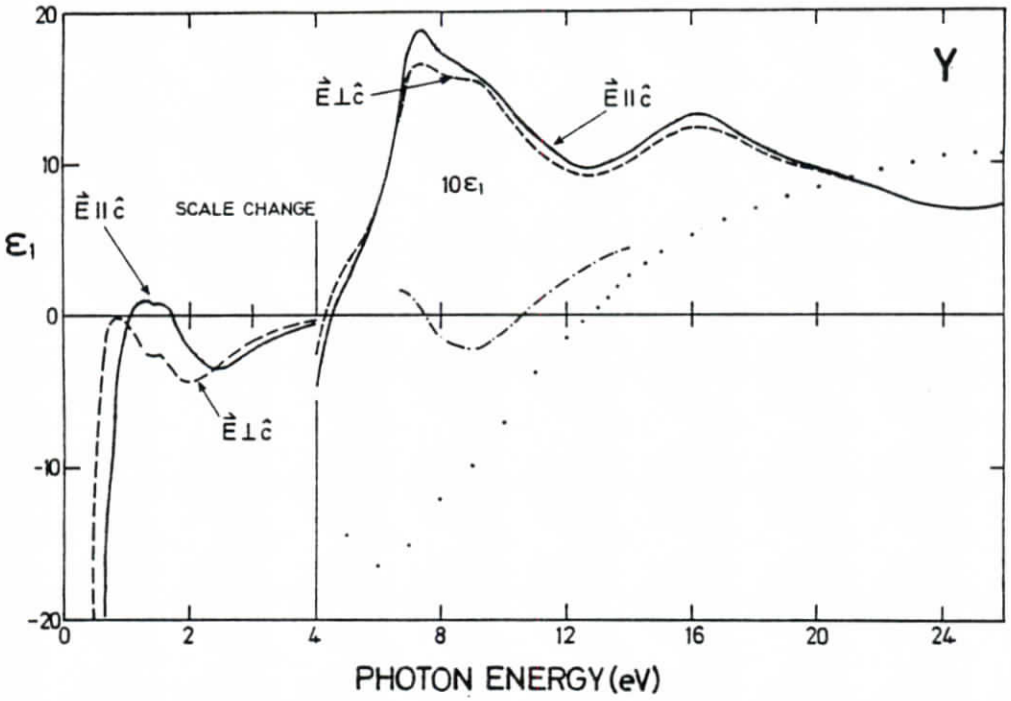

Fig. 28 ε_1 for Y. Single crystal results by WL73 and W077 for $\vec{E}\parallel\hat{c}$ (——) and $\vec{E}\perp\hat{c}$ (---); polycrystalline results by CGT79 (—•—); results by CGW80 (···) derived from electron energy loss measurements.

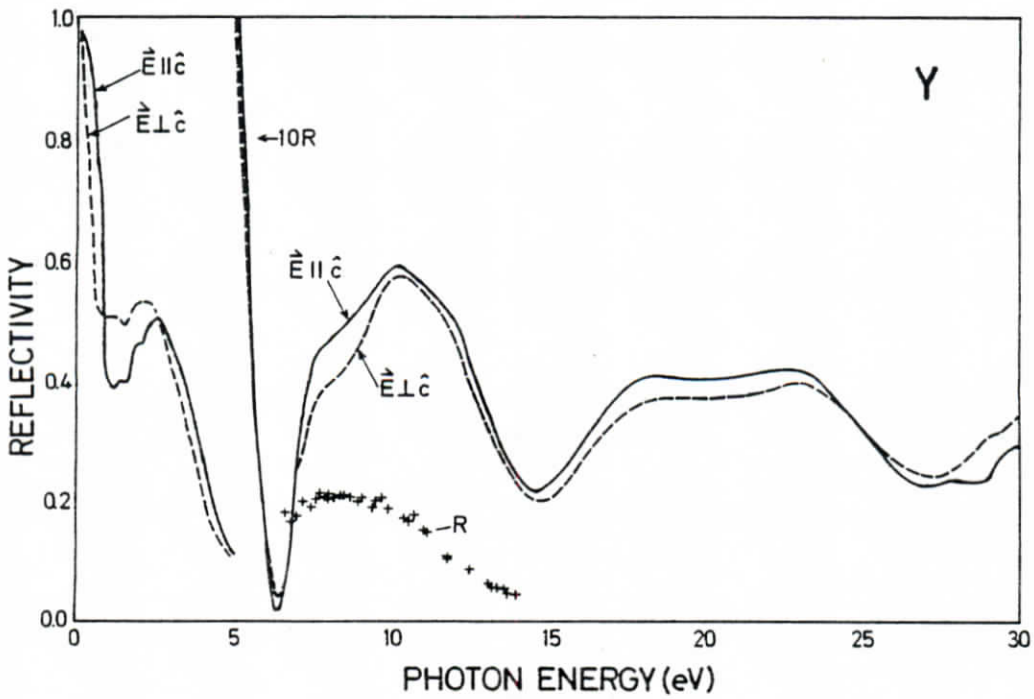

Fig. 27 Reflectivity of Y. Single crystal results by WL73 and W077 for $\vec{E}\parallel\hat{c}$ (——) and $\vec{E}\perp\hat{c}$ (---); polycrystalline results by CGT79 (+++).

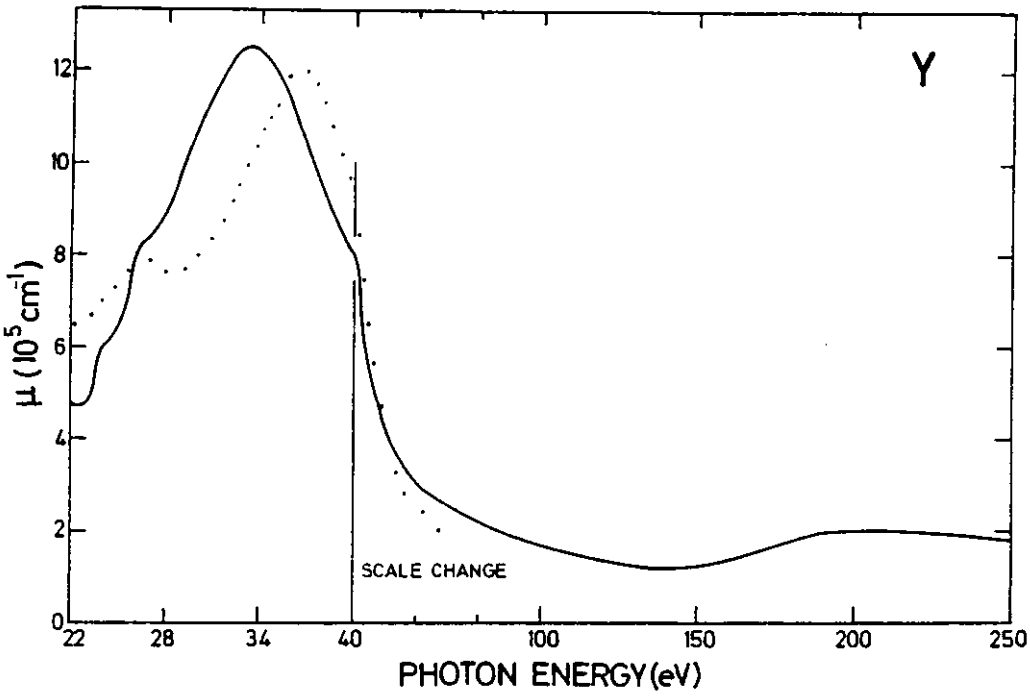

Fig. 30 Absorption coefficient for Y. Polycrystalline Y films results by W076 (——). Results by CGW80 (···) derived from electron energy loss measurements shown with arbitrary units.

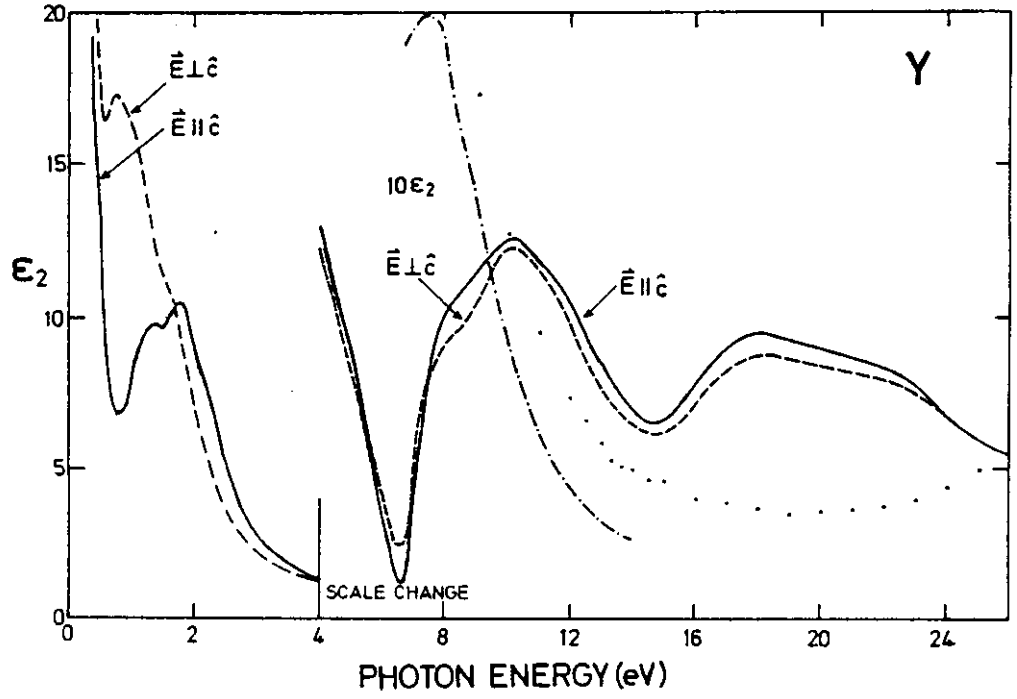

Fig. 29 ε_2 for Y. Single crystal results by WL73 and W077 for $\vec{E} \parallel \hat{c}$(——) and $\vec{E} \perp \hat{c}$ (---); polycrystalline results by CGT79 (—•—); results by CGW80 (···) derived from electron energy loss measurements.

Yttrium single crystal with $\vec{E} \perp \hat{c}$

publications by J.H. Weaver and C.G. Olson in Phys. Rev. B 15, 590 (1977) for energies above 4 eV and by J.H. Weaver and D.W. Lynch in Phys. Rev. B 7, 4737 (1973) for energies between 0.1 and 4.4 eV based on the following tabulations

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
0.10	-461.05	244.93	4.13	29.63	0.00	.982
0.15	-389.75	87.82	2.26	19.66	0.00	.973
0.20	-216.75	47.60	1.61	14.41	0.00	.972
0.22	-177.61	41.26	1.54	13.41	0.00	.967
0.24	-148.78	34.85	1.41	12.28	0.00	.964
0.26	-125.55	30.45	1.35	11.29	0.00	.959
0.28	-107.45	27.32	1.31	10.45	0.00	.954
0.30	-92.91	24.58	1.26	9.72	0.00	.949
0.32	-80.97	22.61	1.24	9.08	0.00	.943
0.34	-71.25	20.85	1.22	8.53	0.00	.937
0.36	-63.06	19.21	1.20	8.03	0.00	.931
0.38	-56.04	17.95	1.18	7.58	0.01	.924
0.40	-50.01	16.72	1.17	7.17	0.01	.917
0.42	-44.80	16.19	1.19	6.80	0.01	.907
0.44	-40.71	15.46	1.19	6.49	0.01	.899
0.46	-37.15	13.87	1.18	6.21	0.01	.891
0.48	-34.08	13.60	1.16	5.95	0.01	.884
0.50	-31.32	12.91	1.13	5.71	0.01	.878
0.52	-29.77	11.79	1.08	5.47	0.01	.874
0.54	-26.20	11.04	1.06	5.23	0.01	.866
0.56	-23.95	10.22	1.02	5.00	0.02	.859
0.58	-21.76	9.60	1.01	4.77	0.02	.850
0.60	-19.78	9.07	1.00	4.56	0.02	.839
0.62	-17.93	8.65	0.99	4.35	0.02	.826
0.64	-16.24	8.31	1.00	4.16	0.02	.812
0.66	-14.81	8.01	1.01	3.94	0.03	.797
0.68	-13.45	7.62	1.06	3.80	0.03	.783
0.70	-12.07	7.39	1.02	3.62	0.04	.763
0.72	-10.66	7.10	1.03	3.45	0.04	.743
0.74	-9.58	6.95	1.06	3.27	0.05	.715
0.76	-8.45	6.92	1.11	3.11	0.06	.686
0.78	-7.46	6.90	1.16	2.97	0.07	.655
0.80	-6.55	6.83	1.21	2.83	0.08	.625
0.82	-5.59	6.93	1.29	2.69	0.09	.587
0.84	-4.90	6.95	1.34	2.59	0.10	.560
0.86	-4.07	7.01	1.42	2.47	0.11	.524
0.88	-3.36	7.15	1.51	2.37	0.11	.494
0.90	-2.74	7.33	1.59	2.30	0.12	.469
0.92	-2.22	7.51	1.67	2.24	0.12	.450
0.94	-1.74	7.68	1.75	2.19	0.12	.434
0.96	-1.35	7.87	1.82	2.16	0.12	.423
0.98	-1.00	8.02	1.88	2.13	0.12	.414
1.00	-0.65	8.18	1.94	2.10	0.12	.406
1.05	-0.06	8.55	2.06	2.08	0.12	.397
1.10	0.40	8.84	2.15	2.06	0.11	.392
1.15	0.75	9.11	2.22	2.05	0.11	.390
1.20	0.95	9.40	2.28	2.06	0.11	.392
1.25	0.99	9.64	2.31	2.09	0.10	.396
1.30	0.96	9.76	2.32	2.10	0.10	.399

Y $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ϕ=0)
1.35	0.91	9.82	2.32	2.12	0.10	.401
1.40	0.89	9.92	2.31	2.13	0.10	.403
1.45	0.81	9.92	2.30	2.12	0.10	.401
1.50	0.87	9.93	2.31	2.11	0.10	.400
1.55	0.88	9.94	2.32	2.12	0.10	.402
1.60	0.93	10.01	2.33	2.15	0.10	.406
1.65	0.94	10.26	2.34	2.20	0.10	.414
1.70	0.80	10.49	2.32	2.26	0.10	.424
1.75	-0.31	10.63	2.27	2.34	0.09	.438
1.80	-0.85	10.46	2.20	2.38	0.09	.447
1.85	-1.42	10.25	2.11	2.42	0.10	.457
1.90	-1.90	9.85	2.01	2.44	0.10	.464
1.95	-2.15	9.36	1.93	2.42	0.10	.466
2.00	-2.36	8.95	1.85	2.41	0.10	.464
2.05	-2.49	8.59	1.80	2.39	0.11	.459
2.10	-2.54	8.30	1.75	2.38	0.11	.470
2.15	-2.51	8.06	1.69	2.38	0.11	.476
2.20	-3.04	7.72	1.62	2.39	0.11	.484
2.25	-3.29	7.30	1.54	2.38	0.11	.491
2.30	-3.41	6.85	1.46	2.35	0.12	.496
2.35	-3.46	6.42	1.36	2.32	0.12	.499
2.40	-3.48	6.01	1.32	2.28	0.12	.502
2.45	-3.48	5.61	1.25	2.25	0.13	.505
2.50	-3.44	5.23	1.19	2.20	0.13	.507
2.60	-3.28	4.52	1.07	2.11	0.15	.504
2.70	-3.01	3.94	0.99	2.00	0.15	.502
2.80	-2.73	3.45	0.92	1.89	0.18	.494
2.90	-2.45	3.11	0.97	1.79	0.20	.481
3.00	-2.21	2.81	0.82	1.70	0.22	.469
3.10	-1.96	2.54	0.79	1.61	0.25	.456
3.20	-1.75	2.32	0.76	1.53	0.27	.440
3.30	-1.55	2.14	0.74	1.45	0.31	.423
3.40	-1.37	1.97	0.72	1.37	0.34	.407
3.50	-1.20	1.83	0.70	1.30	0.38	.389
3.60	-1.04	1.70	0.69	1.23	0.43	.369
3.70	-0.89	1.58	0.68	1.16	0.48	.349
3.80	-0.76	1.49	0.66	1.10	0.53	.328
3.90	-0.64	1.39	0.67	1.04	0.60	.309
4.00	-0.50	1.31	0.67	0.98	0.67	.284
4.10	-0.38	1.25	0.68	0.92	0.73	.259
4.20	-0.29	1.19	0.68	0.87	0.80	.239
4.30	-0.18	1.13	0.69	0.81	0.87	.213
4.40	-0.08	1.10	0.71	0.77	0.90	.191
4.50	-0.03	1.06	0.72	0.74	0.94	.178
4.60	0.04	1.02	0.73	0.70	0.98	.162
4.70	0.09	0.98	0.74	0.67	1.01	.149
4.80	0.15	0.94	0.74	0.63	1.04	.135
4.90	0.20	0.90	0.75	0.60	1.06	.121
5.00	0.25	0.86	0.76	0.56	1.08	.111
5.10	0.29	0.81	0.76	0.54	1.09	.101
5.20	0.34	0.77	0.77	0.50	1.09	.091
5.30	0.36	0.72	0.77	0.47	1.09	.080
5.40	0.42	0.67	0.78	0.43	1.07	.070
5.50	0.46	0.62	0.79	0.39	1.04	.060
5.60	0.51	0.56	0.80	0.35	0.97	.049
5.70	0.55	0.51	0.81	0.31	0.88	.039
5.80	0.62	0.45	0.83	0.27	0.77	.030

$\gamma \vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
5.00	0.84	0.40	0.97	0.21	0.24	.021
5.10	0.75	0.37	0.89	0.20	0.22	.015
5.20	0.64	0.31	0.82	0.17	0.22	.010
5.30	0.49	0.25	0.75	0.13	0.29	.005
5.40	0.98	0.21	0.99	0.11	0.21	.003
5.50	1.02	0.14	1.01	0.07	0.13	.002
5.60	1.07	0.15	1.04	0.07	0.13	.002
5.70	1.14	0.14	1.07	0.06	0.10	.002
5.80	1.21	0.13	1.10	0.06	0.09	.003
5.90	1.33	0.12	1.15	0.05	0.07	.005
6.00	1.43	0.14	1.22	0.06	0.08	.010
6.10	1.52	0.20	1.27	0.08	0.07	.015
6.20	1.74	0.36	1.32	0.11	0.10	.022
6.30	1.80	0.40	1.35	0.15	0.12	.025
6.40	1.85	0.50	1.37	0.18	0.14	.030
6.50	1.87	0.54	1.38	0.21	0.15	.034
6.60	1.88	0.67	1.39	0.24	0.17	.037
6.70	1.89	0.78	1.40	0.28	0.19	.041
6.80	1.85	0.85	1.39	0.30	0.20	.043
6.90	1.82	0.90	1.39	0.32	0.22	.044
7.00	1.79	0.94	1.38	0.34	0.23	.045
7.10	1.76	0.97	1.37	0.35	0.24	.046
7.20	1.73	1.00	1.37	0.36	0.25	.047
7.30	1.71	1.02	1.36	0.37	0.26	.047
7.40	1.69	1.03	1.36	0.38	0.26	.047
7.50	1.66	1.04	1.35	0.39	0.27	.048
7.60	1.66	1.05	1.35	0.39	0.27	.048
7.70	1.65	1.07	1.35	0.40	0.28	.049
7.80	1.64	1.08	1.34	0.40	0.28	.049
7.90	1.63	1.10	1.34	0.41	0.28	.050
8.00	1.62	1.11	1.34	0.41	0.29	.051
8.10	1.60	1.12	1.33	0.42	0.29	.051
8.20	1.59	1.13	1.33	0.43	0.30	.052
8.30	1.58	1.14	1.33	0.43	0.30	.052
8.40	1.57	1.15	1.33	0.43	0.30	.053
8.50	1.56	1.17	1.33	0.44	0.31	.054
8.60	1.54	1.19	1.32	0.45	0.31	.054
8.70	1.53	1.20	1.32	0.46	0.32	.055
8.80	1.51	1.21	1.31	0.46	0.32	.056
8.90	1.49	1.23	1.31	0.47	0.33	.057
9.00	1.47	1.24	1.30	0.47	0.34	.057
9.10	1.44	1.25	1.29	0.48	0.34	.058
9.20	1.42	1.26	1.29	0.49	0.35	.059
9.30	1.39	1.26	1.28	0.50	0.36	.059
9.40	1.36	1.26	1.27	0.50	0.37	.059
9.50	1.33	1.26	1.26	0.50	0.38	.060
9.60	1.30	1.25	1.25	0.50	0.38	.059
9.70	1.27	1.24	1.24	0.50	0.39	.059
9.80	1.23	1.22	1.22	0.50	0.41	.058
9.90	1.20	1.20	1.20	0.50	0.42	.057
10.00	1.17	1.18	1.19	0.50	0.43	.056
10.10	1.14	1.16	1.17	0.49	0.44	.055
10.20	1.11	1.14	1.15	0.49	0.45	.054
10.30	1.08	1.11	1.13	0.49	0.46	.053
10.40	1.05	1.08	1.11	0.48	0.48	.052
10.50	1.02	1.05	1.12	0.47	0.49	.050
10.60	0.99	1.01	1.10	0.46	0.50	.049

$\gamma \vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
12.40	0.96	0.96	1.04	0.44	0.51	.045
12.50	0.96	0.92	1.08	0.43	0.51	.042
12.60	0.95	0.88	1.07	0.41	0.51	.039
12.70	0.94	0.84	1.07	0.39	0.50	.036
12.80	0.94	0.81	1.07	0.38	0.49	.034
12.90	1.00	0.77	1.07	0.36	0.48	.031
13.00	1.02	0.74	1.07	0.35	0.46	.029
13.50	1.04	0.72	1.07	0.33	0.45	.027
14.00	1.07	0.69	1.08	0.32	0.43	.025
14.20	1.09	0.67	1.09	0.31	0.41	.023
14.40	1.12	0.66	1.10	0.30	0.39	.022
14.60	1.16	0.66	1.12	0.29	0.37	.022
14.80	1.19	0.66	1.13	0.29	0.36	.022
15.00	1.22	0.67	1.14	0.29	0.35	.023
15.20	1.25	0.66	1.15	0.30	0.34	.023
15.40	1.27	0.71	1.17	0.30	0.34	.025
15.60	1.28	0.73	1.17	0.31	0.34	.026
15.80	1.29	0.76	1.18	0.32	0.34	.028
16.00	1.29	0.78	1.18	0.33	0.34	.029
16.20	1.29	0.81	1.19	0.34	0.35	.031
16.40	1.29	0.84	1.19	0.35	0.36	.032
16.60	1.27	0.85	1.19	0.35	0.36	.033
16.80	1.26	0.86	1.18	0.37	0.37	.035
17.00	1.24	0.91	1.19	0.38	0.38	.037
17.20	1.22	0.92	1.17	0.39	0.40	.038
17.40	1.19	0.93	1.16	0.40	0.41	.039
17.60	1.17	0.94	1.15	0.41	0.42	.040
17.80	1.14	0.95	1.15	0.41	0.43	.040
18.00	1.12	0.95	1.14	0.42	0.44	.041
18.20	1.09	0.95	1.13	0.42	0.45	.041
18.40	1.07	0.94	1.12	0.42	0.46	.041
18.60	1.05	0.94	1.11	0.42	0.47	.041
18.80	1.04	0.93	1.10	0.42	0.48	.041
19.00	1.02	0.92	1.10	0.42	0.49	.041
19.20	1.01	0.92	1.09	0.42	0.49	.041
19.40	0.99	0.91	1.08	0.42	0.50	.041
19.60	0.98	0.90	1.08	0.42	0.51	.041
19.80	0.97	0.90	1.07	0.42	0.52	.041
20.00	0.95	0.89	1.06	0.42	0.52	.041
20.20	0.94	0.89	1.06	0.42	0.53	.041
20.40	0.93	0.88	1.05	0.42	0.54	.041
20.60	0.92	0.88	1.05	0.42	0.54	.041
20.80	0.90	0.87	1.04	0.42	0.55	.041
21.00	0.89	0.87	1.03	0.42	0.56	.041
21.20	0.88	0.86	1.03	0.42	0.57	.041
21.40	0.86	0.86	1.02	0.42	0.58	.041
21.60	0.85	0.85	1.01	0.42	0.59	.042
21.80	0.84	0.84	1.01	0.42	0.60	.042
22.00	0.82	0.83	1.00	0.42	0.61	.042
22.20	0.81	0.82	0.99	0.42	0.62	.042
22.40	0.79	0.81	0.98	0.41	0.63	.042
22.60	0.78	0.80	0.97	0.41	0.64	.042
22.80	0.76	0.79	0.96	0.41	0.66	.042
23.00	0.75	0.77	0.95	0.41	0.67	.042
23.20	0.73	0.76	0.94	0.40	0.68	.041
23.40	0.72	0.74	0.94	0.39	0.69	.041
23.60	0.71	0.72	0.93	0.39	0.71	.041

Y $\vec{E} \parallel \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
24.00	0.71	0.59	0.92	0.33	0.71	.034
24.10	0.70	0.64	0.92	0.37	0.71	.035
24.20	0.70	0.65	0.91	0.36	0.71	.034
24.30	0.70	0.64	0.91	0.35	0.71	.033
24.40	0.70	0.63	0.91	0.34	0.71	.033
24.50	0.71	0.61	0.91	0.34	0.70	.032
24.60	0.71	0.60	0.90	0.33	0.69	.032
24.70	0.71	0.59	0.90	0.32	0.69	.030
24.80	0.72	0.57	0.90	0.32	0.68	.029
24.90	0.73	0.56	0.91	0.31	0.67	.029
25.00	0.73	0.55	0.91	0.30	0.66	.027
25.10	0.74	0.54	0.91	0.30	0.64	.026
25.20	0.75	0.53	0.91	0.29	0.63	.025
25.30	0.75	0.53	0.92	0.29	0.62	.025
25.40	0.76	0.53	0.92	0.29	0.61	.024
25.50	0.76	0.53	0.93	0.28	0.59	.023
25.60	0.76	0.54	0.93	0.29	0.60	.023
25.70	0.77	0.55	0.93	0.29	0.60	.024
25.80	0.77	0.56	0.93	0.30	0.62	.025
25.90	0.75	0.56	0.92	0.31	0.64	.027
29.50	0.73	0.56	0.91	0.31	0.67	.028
30.00	0.70	0.56	0.89	0.31	0.70	.030

Yttrium single crystal with $\vec{E} \perp \hat{c}$

publications by J.H. Weaver and C.G. Olson in Phys. Rev. B 15, 590 (1977) for energies above 4 eV and by J.H. Weaver and D.W. Lynch in Phys. Rev. B 7, 4737 (1973) for energies between 0.1 and 4.4 eV based on the following tabulation

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
0.10	-4478.59	2505.33	18.48	69.43	0.00	.986
0.10	-487.94	191.32	4.60	22.39	0.00	.972
0.15	-211.24	72.94	2.47	14.74	0.00	.957
0.20	-114.60	48.64	2.22	10.93	0.00	.932
0.22	-92.82	44.18	2.18	9.68	0.00	.919
0.24	-76.94	38.71	2.14	9.03	0.01	.900
0.26	-64.30	34.49	2.04	8.29	0.01	.894
0.28	-53.70	32.06	2.10	7.62	0.01	.876
0.30	-45.71	31.18	2.13	7.09	0.01	.858
0.32	-39.44	28.63	2.16	6.64	0.01	.840
0.34	-34.63	26.87	2.14	6.26	0.01	.825
0.36	-30.43	25.05	2.12	5.91	0.02	.810
0.38	-26.84	23.38	2.10	5.57	0.02	.794
0.40	-23.23	21.94	2.04	5.25	0.02	.775
0.42	-20.24	20.50	2.10	4.97	0.02	.755
0.44	-17.41	19.63	2.10	4.72	0.03	.736
0.46	-15.59	18.59	2.08	4.46	0.03	.717
0.48	-13.05	17.73	2.12	4.19	0.04	.689
0.50	-10.90	17.25	2.18	3.96	0.04	.661
0.52	-9.12	16.88	2.24	3.76	0.05	.636
0.54	-7.46	16.60	2.32	3.58	0.05	.611
0.56	-6.01	16.45	2.40	3.43	0.05	.589
0.58	-4.70	16.42	2.49	3.30	0.06	.568
0.60	-3.64	16.51	2.58	3.20	0.06	.551
0.62	-2.76	16.63	2.65	3.13	0.06	.542
0.64	-2.07	16.79	2.72	3.08	0.06	.538
0.66	-1.54	16.92	2.78	3.04	0.06	.529
0.68	-1.10	17.03	2.83	3.01	0.06	.523
0.70	-0.75	17.14	2.87	2.99	0.06	.520
0.72	-0.58	17.25	2.89	2.99	0.06	.519
0.74	-0.41	17.23	2.90	2.97	0.06	.517
0.76	-0.25	17.21	2.91	2.95	0.06	.515
0.78	-0.15	17.21	2.92	2.95	0.06	.514
0.80	-0.09	17.16	2.92	2.94	0.06	.513
0.82	-0.06	17.16	2.92	2.93	0.06	.513
0.84	-0.09	17.12	2.92	2.93	0.06	.513
0.86	-0.13	17.02	2.91	2.93	0.06	.512
0.88	-0.17	16.92	2.89	2.92	0.06	.512
0.90	-0.22	16.82	2.88	2.92	0.06	.511
0.92	-0.30	16.72	2.87	2.92	0.06	.511
0.94	-0.37	16.59	2.85	2.91	0.06	.511
0.96	-0.47	16.47	2.83	2.91	0.06	.511
0.98	-0.54	16.33	2.81	2.90	0.06	.510
1.00	-0.66	16.23	2.79	2.91	0.06	.511
1.05	-0.99	15.85	2.73	2.90	0.06	.511
1.10	-1.33	15.42	2.66	2.90	0.06	.513
1.15	-1.65	14.93	2.59	2.89	0.07	.512
1.20	-1.94	14.41	2.51	2.88	0.07	.512
1.25	-2.29	13.91	2.42	2.85	0.07	.512

Y $\vec{E} \perp \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
1.30	-2.45	13.20	2.34	2.82	0.77	.519
1.35	-2.55	12.64	2.27	2.78	0.68	.507
1.40	-2.62	12.13	2.21	2.74	0.64	.504
1.45	-2.61	11.65	2.16	2.70	0.68	.500
1.50	-2.56	11.37	2.13	2.67	0.68	.495
1.55	-2.71	11.19	2.10	2.67	0.65	.498
1.60	-2.97	10.98	2.05	2.67	0.64	.502
1.65	-3.22	10.62	1.99	2.68	0.69	.506
1.70	-3.54	10.27	1.91	2.68	0.69	.512
1.75	-3.85	9.82	1.83	2.68	0.69	.519
1.80	-4.13	9.29	1.74	2.67	0.69	.525
1.85	-4.31	8.70	1.64	2.65	0.69	.530
1.90	-4.39	8.09	1.55	2.61	0.70	.533
1.95	-4.37	7.54	1.47	2.56	0.70	.534
2.00	-4.31	7.03	1.40	2.51	0.70	.534
2.05	-4.22	6.58	1.34	2.45	0.71	.534
2.10	-4.12	6.18	1.29	2.40	0.71	.532
2.15	-4.02	5.84	1.24	2.36	0.72	.531
2.20	-4.00	5.46	1.18	2.32	0.72	.535
2.25	-3.91	5.06	1.11	2.27	0.72	.537
2.30	-3.77	4.68	1.06	2.21	0.73	.536
2.35	-3.61	4.34	1.01	2.15	0.74	.534
2.40	-3.41	4.04	0.97	2.09	0.74	.529
2.45	-3.23	3.78	0.93	2.02	0.75	.523
2.50	-3.03	3.56	0.90	1.96	0.76	.516
2.55	-2.89	3.20	0.86	1.85	0.78	.500
2.70	-2.39	2.90	0.83	1.75	0.81	.484
2.80	-2.12	2.65	0.80	1.66	0.83	.467
2.90	-1.89	2.43	0.77	1.57	0.86	.450
3.00	-1.66	2.24	0.75	1.49	0.89	.432
3.10	-1.46	2.07	0.73	1.41	0.92	.414
3.20	-1.27	1.94	0.72	1.34	0.96	.392
3.30	-1.11	1.82	0.71	1.27	0.40	.372
3.40	-0.95	1.71	0.71	1.21	0.45	.352
3.50	-0.82	1.61	0.70	1.14	0.49	.333
3.60	-0.68	1.52	0.70	1.08	0.55	.310
3.70	-0.57	1.44	0.70	1.03	0.60	.290
3.80	-0.46	1.36	0.70	0.97	0.66	.270
3.90	-0.34	1.30	0.71	0.92	0.72	.248
4.00	-0.25	1.24	0.71	0.87	0.78	.227
4.10	-0.15	1.19	0.72	0.82	0.83	.206
4.20	-0.06	1.14	0.74	0.78	0.87	.187
4.30	0.02	1.11	0.75	0.74	0.90	.168
4.40	0.09	1.08	0.77	0.71	0.92	.153
4.50	0.14	1.06	0.78	0.68	0.93	.141
4.60	0.19	1.03	0.79	0.65	0.94	.131
4.70	0.23	1.00	0.79	0.63	0.95	.123
4.80	0.27	0.96	0.80	0.60	0.96	.113
4.90	0.30	0.93	0.80	0.58	0.97	.106
5.00	0.34	0.89	0.80	0.56	0.98	.098
5.10	0.35	0.85	0.80	0.53	1.00	.093
5.20	0.39	0.80	0.80	0.50	1.01	.083
5.30	0.43	0.75	0.80	0.47	1.01	.074
5.40	0.47	0.70	0.81	0.43	0.99	.065
5.50	0.51	0.65	0.81	0.40	0.96	.055
5.60	0.56	0.60	0.83	0.36	0.90	.046
5.70	0.60	0.55	0.84	0.33	0.83	.034

Y $\vec{E} \perp \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
5.80	0.66	0.50	0.86	0.29	0.73	.024
5.90	0.72	0.46	0.89	0.26	0.63	.022
6.00	0.77	0.43	0.91	0.24	0.56	.018
6.10	0.82	0.38	0.93	0.21	0.47	.013
6.20	0.89	0.33	0.96	0.17	0.37	.008
6.30	0.97	0.29	1.00	0.15	0.24	.005
6.35	1.01	0.27	1.01	0.14	0.25	.004
6.40	1.06	0.26	1.04	0.12	0.22	.004
6.45	1.12	0.25	1.06	0.12	0.19	.004
6.50	1.17	0.25	1.09	0.11	0.17	.005
6.60	1.27	0.26	1.13	0.12	0.16	.007
6.70	1.35	0.25	1.17	0.11	0.13	.008
6.80	1.44	0.30	1.23	0.12	0.13	.011
6.90	1.56	0.38	1.27	0.15	0.15	.018
7.00	1.63	0.47	1.29	0.18	0.16	.022
7.10	1.65	0.57	1.31	0.22	0.18	.026
7.20	1.65	0.64	1.31	0.24	0.20	.029
7.30	1.66	0.69	1.32	0.26	0.21	.031
7.40	1.65	0.74	1.32	0.28	0.23	.033
7.50	1.64	0.76	1.32	0.30	0.24	.034
7.60	1.63	0.82	1.32	0.31	0.25	.036
7.70	1.62	0.85	1.31	0.32	0.25	.037
7.80	1.61	0.87	1.31	0.33	0.26	.038
7.90	1.59	0.89	1.31	0.34	0.27	.039
8.00	1.58	0.91	1.30	0.35	0.27	.039
8.10	1.57	0.92	1.30	0.35	0.28	.040
8.20	1.56	0.92	1.30	0.35	0.28	.039
8.30	1.57	0.94	1.30	0.36	0.28	.041
8.40	1.56	0.95	1.30	0.37	0.28	.041
8.50	1.56	0.97	1.30	0.37	0.29	.042
8.60	1.55	0.98	1.30	0.38	0.29	.043
8.70	1.55	0.99	1.30	0.38	0.29	.043
8.80	1.55	1.01	1.30	0.39	0.29	.045
8.90	1.55	1.03	1.31	0.39	0.30	.045
9.00	1.55	1.05	1.31	0.40	0.30	.047
9.10	1.54	1.07	1.31	0.41	0.31	.048
9.20	1.52	1.10	1.30	0.42	0.31	.049
9.30	1.51	1.11	1.30	0.43	0.32	.050
9.40	1.50	1.13	1.30	0.44	0.32	.051
9.50	1.48	1.15	1.29	0.44	0.33	.052
9.60	1.46	1.17	1.29	0.46	0.34	.053
9.70	1.43	1.19	1.28	0.46	0.34	.054
9.80	1.41	1.21	1.28	0.47	0.35	.055
9.90	1.38	1.22	1.27	0.48	0.36	.056
10.00	1.44	1.22	1.26	0.49	0.37	.057
10.10	1.31	1.23	1.25	0.49	0.38	.057
10.20	1.28	1.23	1.24	0.50	0.39	.059
10.30	1.25	1.22	1.22	0.50	0.40	.058
10.40	1.22	1.22	1.21	0.50	0.41	.059
10.50	1.17	1.19	1.19	0.50	0.43	.057
10.60	1.13	1.17	1.17	0.50	0.44	.056
11.00	1.09	1.14	1.16	0.49	0.46	.055
11.20	1.05	1.12	1.14	0.49	0.47	.054
11.40	1.02	1.09	1.12	0.49	0.49	.053
11.60	0.99	1.06	1.11	0.48	0.50	.051
11.80	0.97	1.02	1.09	0.47	0.52	.050
12.00	0.94	0.99	1.07	0.46	0.53	.048

Y $\vec{E} \perp \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
12.20	0.93	0.94	1.06	0.44	0.54	.045
12.40	0.93	0.93	1.05	0.42	0.54	.042
12.60	0.93	0.90	1.05	0.41	0.54	.039
12.80	0.93	0.92	1.04	0.40	0.54	.040
13.00	0.93	0.88	1.04	0.38	0.53	.038
13.20	0.94	0.85	1.04	0.36	0.52	.037
13.40	0.95	0.82	1.04	0.35	0.50	.034
13.60	0.97	0.80	1.04	0.34	0.49	.033
13.80	0.99	0.87	1.05	0.42	0.47	.041
14.00	1.02	0.85	1.05	0.41	0.45	.039
14.20	1.04	0.83	1.06	0.40	0.43	.037
14.40	1.07	0.83	1.07	0.39	0.41	.037
14.60	1.10	0.82	1.09	0.38	0.39	.036
14.80	1.12	0.82	1.10	0.38	0.38	.036
15.00	1.15	0.83	1.11	0.38	0.37	.036
15.20	1.17	0.84	1.12	0.38	0.36	.037
15.40	1.19	0.85	1.13	0.38	0.35	.037
15.60	1.21	0.86	1.14	0.38	0.35	.038
15.80	1.22	0.87	1.15	0.38	0.35	.038
16.00	1.23	0.87	1.15	0.38	0.36	.038
16.20	1.23	0.86	1.15	0.37	0.36	.037
16.40	1.22	0.87	1.15	0.38	0.37	.038
16.60	1.21	0.88	1.15	0.38	0.38	.038
16.80	1.20	0.91	1.15	0.39	0.39	.039
17.00	1.18	0.93	1.15	0.40	0.40	.040
17.20	1.17	0.95	1.14	0.41	0.41	.041
17.40	1.15	0.96	1.14	0.38	0.42	.039
17.60	1.13	0.97	1.13	0.38	0.43	.039
17.80	1.10	0.97	1.12	0.39	0.44	.040
18.00	1.08	0.98	1.11	0.39	0.45	.040
18.20	1.07	0.97	1.11	0.40	0.46	.040
18.40	1.05	0.97	1.10	0.40	0.47	.040
18.60	1.03	0.97	1.09	0.40	0.48	.040
18.80	1.01	0.97	1.08	0.40	0.49	.040
19.00	1.00	0.96	1.08	0.40	0.50	.040
19.20	0.98	0.96	1.07	0.40	0.50	.040
19.40	0.97	0.95	1.06	0.40	0.51	.040
19.60	0.96	0.95	1.06	0.40	0.52	.040
19.80	0.95	0.94	1.05	0.40	0.52	.040
20.00	0.94	0.94	1.05	0.40	0.53	.040
20.20	0.93	0.93	1.04	0.40	0.54	.040
20.40	0.92	0.93	1.04	0.40	0.54	.040
20.60	0.90	0.93	1.03	0.40	0.55	.040
20.80	0.89	0.92	1.03	0.40	0.56	.040
21.00	0.88	0.92	1.02	0.40	0.57	.040
21.20	0.87	0.91	1.01	0.40	0.57	.040
21.40	0.86	0.91	1.01	0.40	0.58	.040
21.60	0.85	0.90	1.00	0.40	0.59	.040
21.80	0.83	0.90	1.00	0.40	0.60	.040
22.00	0.82	0.79	0.99	0.40	0.61	.039
22.20	0.81	0.79	0.99	0.40	0.62	.039
22.40	0.80	0.78	0.98	0.40	0.63	.039
22.60	0.78	0.77	0.97	0.40	0.64	.040
22.80	0.76	0.76	0.96	0.40	0.65	.040
23.00	0.75	0.75	0.95	0.39	0.67	.040
23.20	0.74	0.74	0.94	0.39	0.68	.040
23.40	0.73	0.72	0.94	0.39	0.69	.039

Y $\vec{E} \perp \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
23.60	0.72	0.70	0.93	0.38	0.69	.038
23.80	0.71	0.69	0.92	0.37	0.70	.038
24.00	0.71	0.67	0.92	0.37	0.70	.037
24.20	0.70	0.65	0.91	0.36	0.71	.036
24.40	0.70	0.64	0.91	0.35	0.71	.035
24.60	0.70	0.62	0.90	0.34	0.71	.034
24.80	0.70	0.61	0.90	0.34	0.70	.033
25.00	0.70	0.59	0.90	0.33	0.70	.032
25.20	0.71	0.58	0.90	0.32	0.69	.031
25.40	0.71	0.57	0.90	0.31	0.68	.029
25.60	0.72	0.56	0.90	0.31	0.67	.029
25.80	0.73	0.55	0.90	0.30	0.66	.027
26.00	0.73	0.55	0.91	0.30	0.65	.026
26.20	0.74	0.54	0.91	0.30	0.64	.026
26.40	0.75	0.54	0.91	0.29	0.63	.025
26.60	0.75	0.54	0.91	0.29	0.63	.025
27.00	0.77	0.53	0.92	0.29	0.61	.024
27.50	0.78	0.55	0.93	0.29	0.61	.024
28.00	0.77	0.56	0.93	0.30	0.62	.025
28.50	0.75	0.58	0.92	0.32	0.64	.028
29.00	0.72	0.59	0.91	0.33	0.66	.030
29.50	0.69	0.59	0.90	0.33	0.71	.042

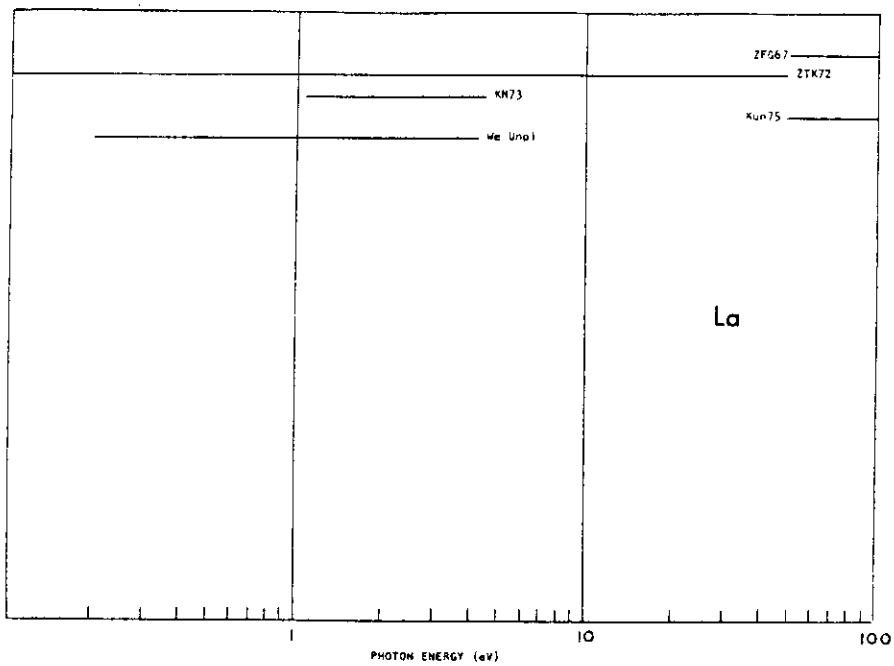

Fig. 31 Survey of available data on La.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		La
FZG67	95-105			x				μ	absorption measurements
ZFG67	50-520	Trans							absorption measurements
MSB72	1.92		1073-1500					ε	emissivity of liquid La
ZTK72	0-50	Trans	1123	x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
KN73	1.13-4.42	Ellips				x	EP	n,k,σ	
BKS74	826-861			x				μ	absorption measurements
Kun75	50-550	Trans		x				μ	absorption measurements with synchrotron radiation
SIS75	100-160	Trans		x				μ	absorption measurements
BKB76	1.92		>1000			x	EP	ε_N	emissivity
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
We Unpl	0.2-4.2	Refl	4.2			x	EP,Ex	A	absorptivity measured by calorimetry

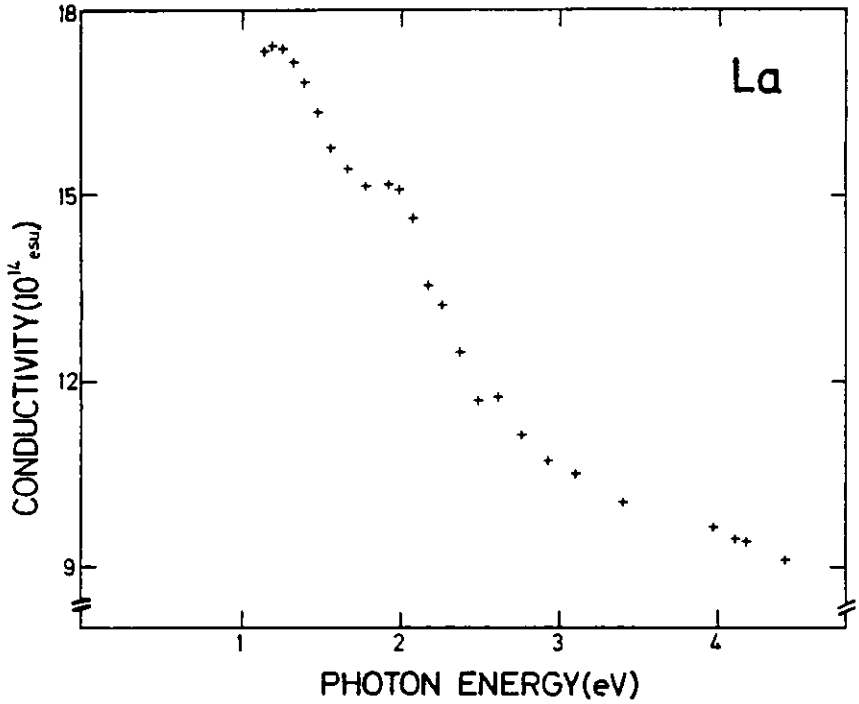

Fig. 33 Optical conductivity for La. Polycrystalline results by KN73.

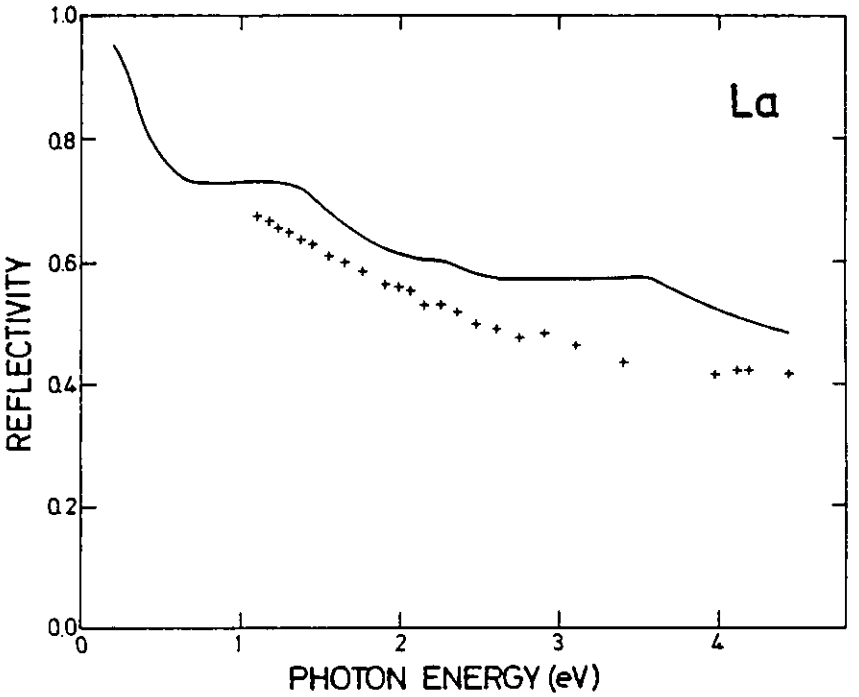

Fig. 32 Reflectivity for La. Polycrystalline results by We Unpub (——) and KN73 (+++).

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Ce
FZG67	102-115	Trans		x				μ	absorption measurements
ZFG67	50-520	Trans		x				μ	absorption measurements
HRS70	100-180	Trans		x			In	μ	absorption measurements with synchrotron radiation
GK72	95-160							μ	absorption measurements
MSB72	1.92		1100-1500					ε	emissivity of molten Ce
Pet72	1.55-6.2	Trans, Refl		x				T,R,σ	
ZTK72	0-50	Trans		x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
BKS74	873-906			x				μ	absorption measurements
Kun75	50-550	Trans		x				μ	absorption measurements with synchrotron radiation
SIS75	100-160	Trans		x				μ	absorption measurements
BKB76	1.92		>1000			x	EP	ε_N	emissivity
WBR76	100-150		1600-1900					μ	absorption measurements with synchrotron radiation, vapor sample
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties

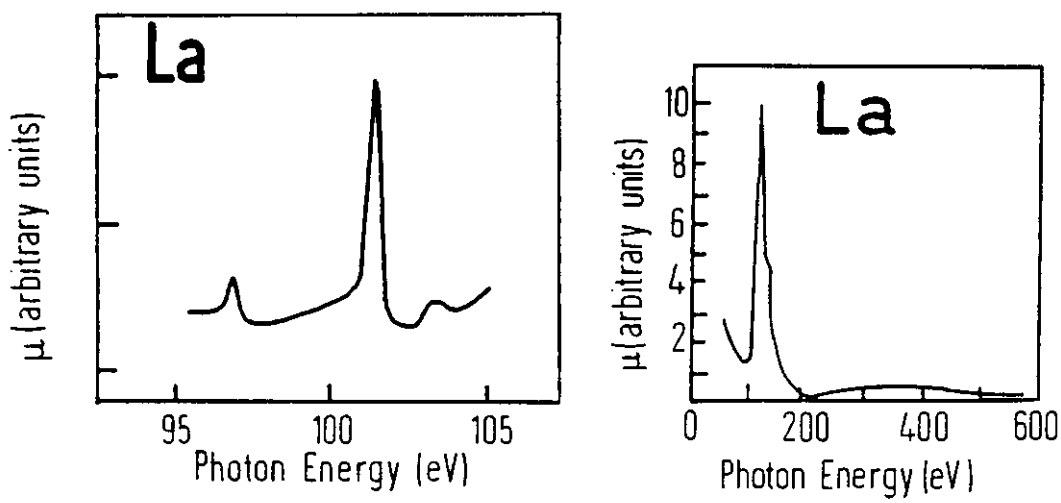

Fig. 34 Absorption coefficient for La. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

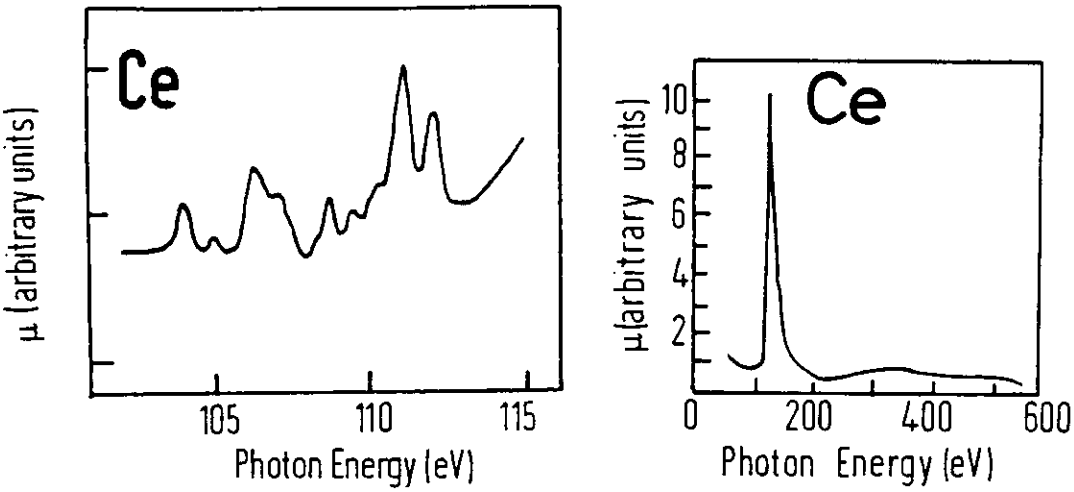

Fig. 36 Absorption coefficient for Ce. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

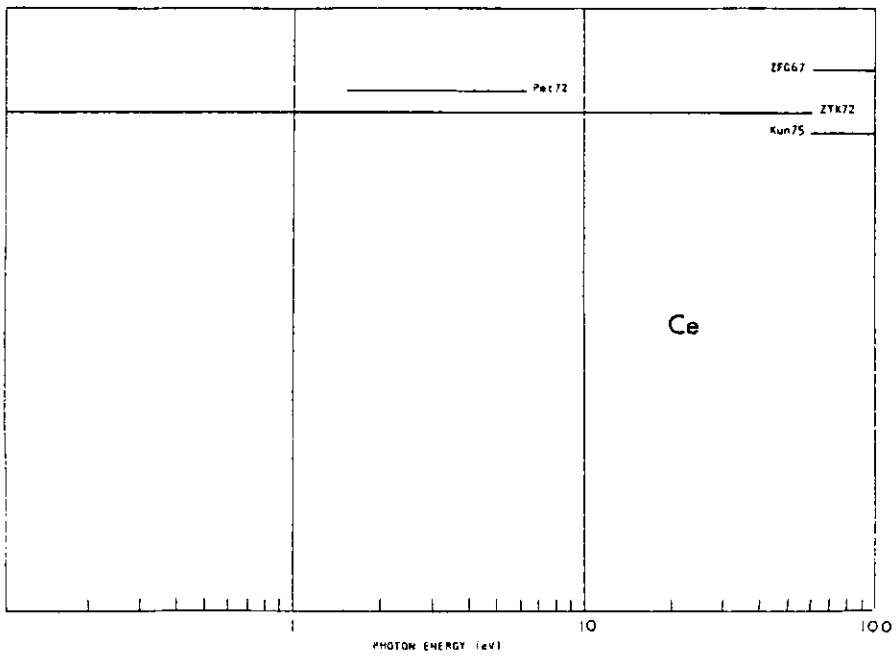

Fig. 35 Survey of available data on Ce.

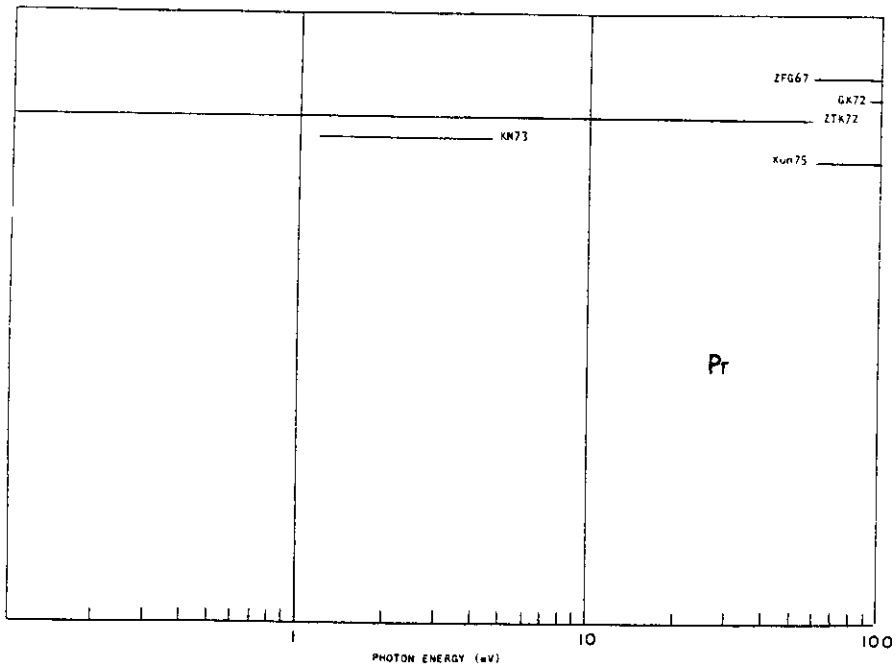

Fig. 37 Survey of available data on Pr.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Pr
FZG67	112-120	Trans		x				μ	absorption measurements
ZFG67	50-520	Trans		x				μ	absorption measurements
HRS70	100-180	Trans		x			In	μ	absorption measurements
GK72	90-170							μ	absorption measurements
MSB72	1.92		1100-1500					ε	emissivity
ZTK72	0-50	Trans	1123	x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
KN73	1.13-4.42	Ellips				x	MP	n,k,σ	
TC73	120-170			x				μ	energy loss spectroscopy
Kun75	50-550	Trans		x				μ	absorption measurements with synchrotron radiation
BKB76	1.92		>1000				EP	ε_N	emissivity
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties

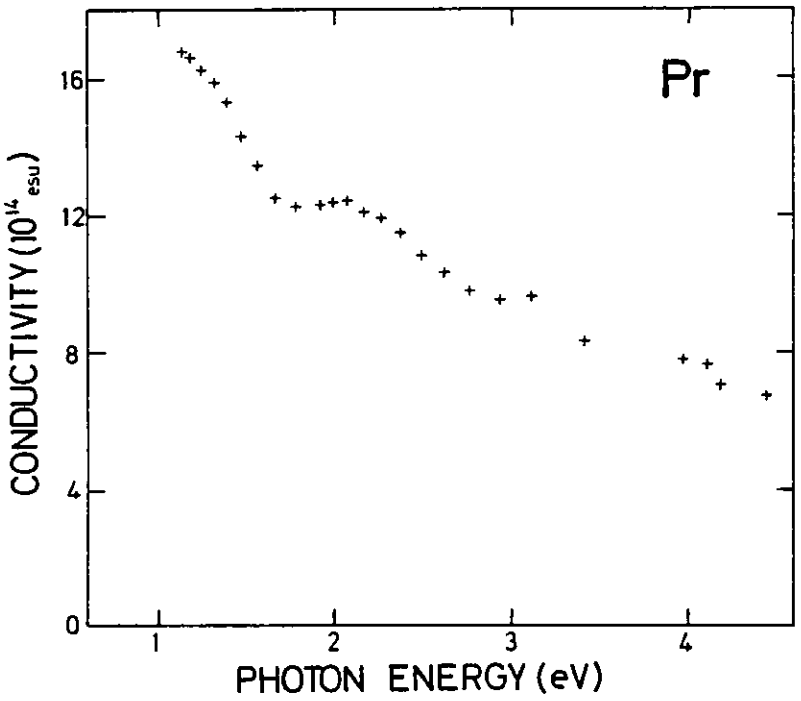

Fig. 39 Optical conductivity of Pr. Polycrystalline results by KN73.

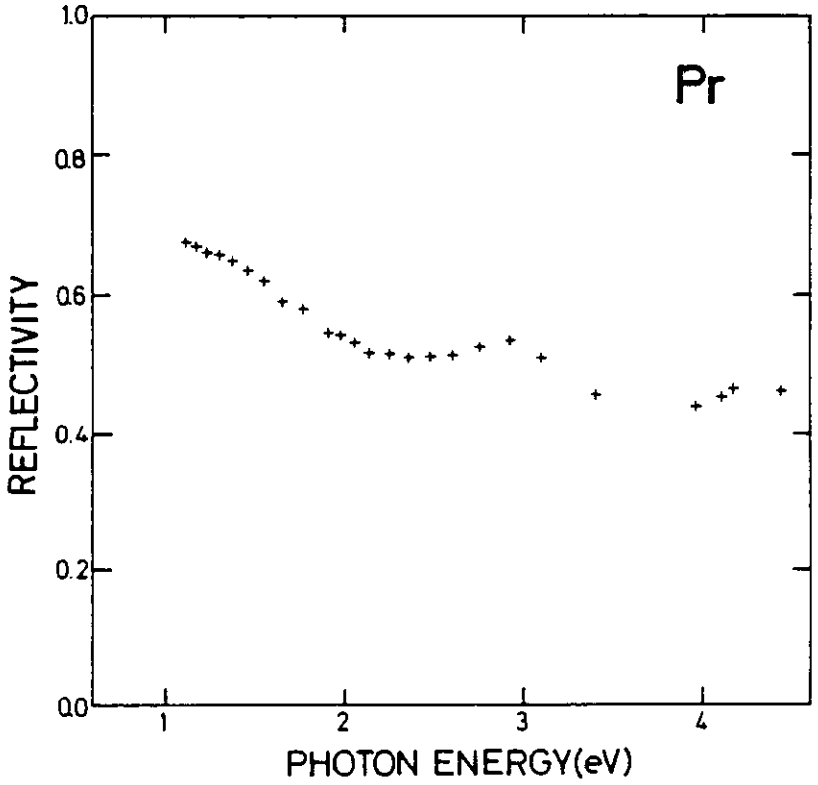

Fig. 38 Reflectivity of Pr. Polycrystalline results by KN73.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Nd
				Film	X-tal	Bulk	Prep		
Ker57	1.41-3.14	Trans, Refl		x				R,n,μ	
FZG67	109-122	Trans		x				μ	absorption measurements
ZFG67	50-520	Trans		x				μ	absorption measurements
HRS70	100-180	Trans		x			In	μ	absorption measurements with synchrotron radiation
Pet72	1.55-6.2	Trans, Refl		x				T,R,σ	
ZTK72	0-50		1123	x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
KN73	1.13-4.43	Ellips				x		n,k,σ	
TC73	114-150			x				μ	energy loss spectroscopy
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
BKB76	1.92		>1000				EP	ε_N	emissivity
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties

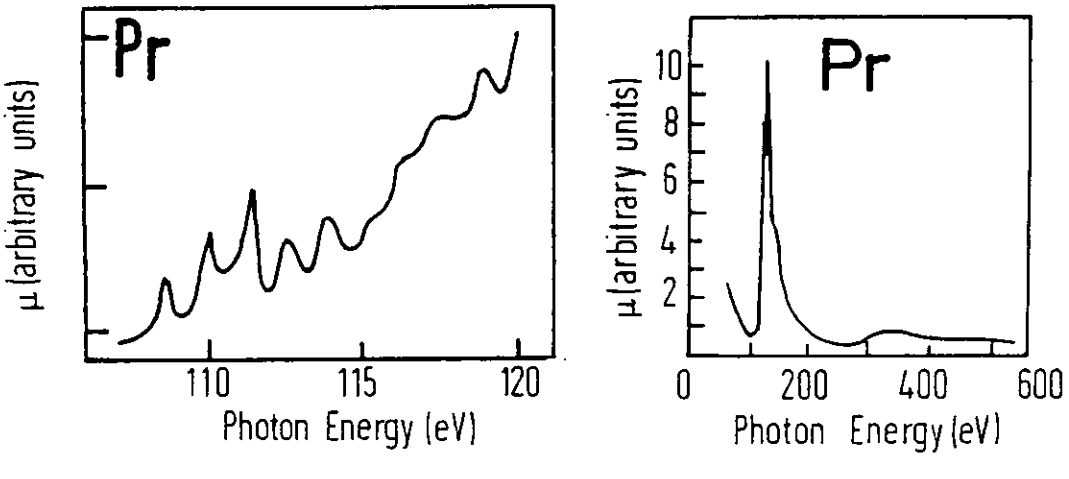

Fig. 40 Absorption coefficient of Pr. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

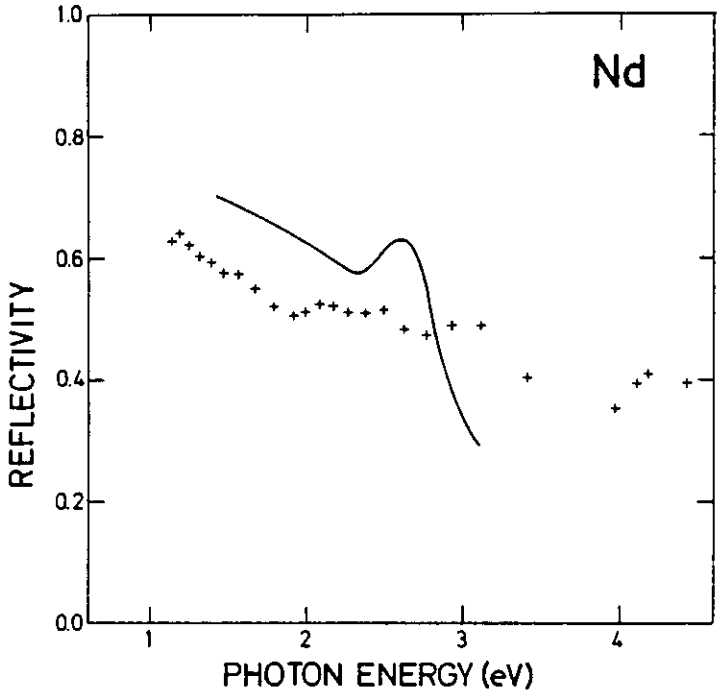

Fig. 42 Reflectivity of Nd. Polycrystalline results by KN73 (+++) and Ker57 (——).

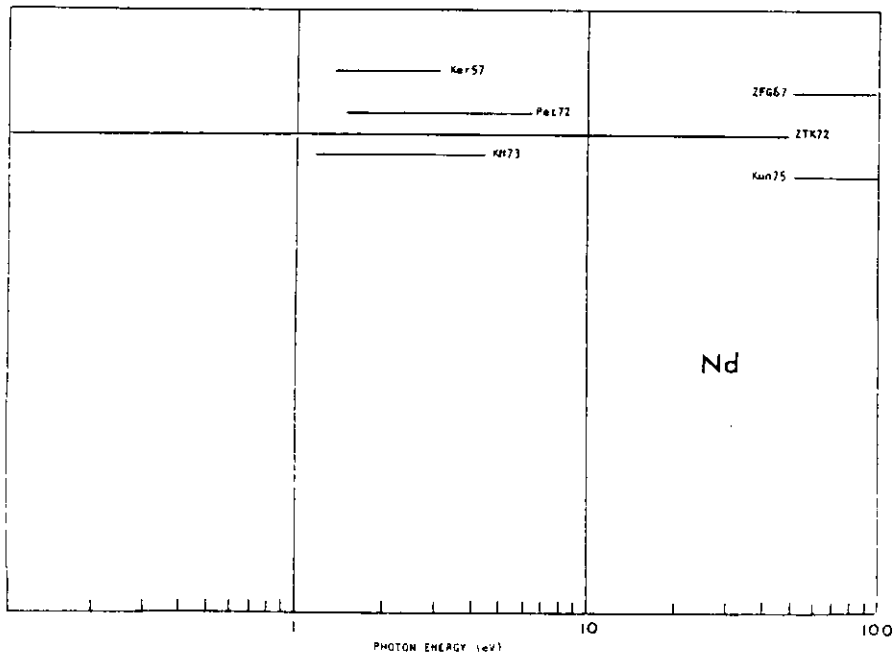

Fig. 41 Survey of available data on Nd.

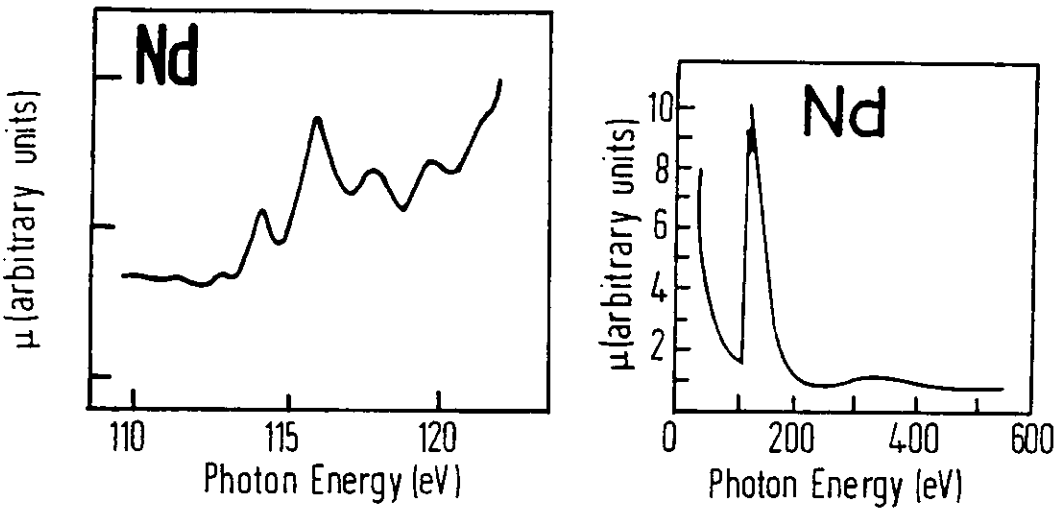

Fig. 44 Absorption coefficient of Nd. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

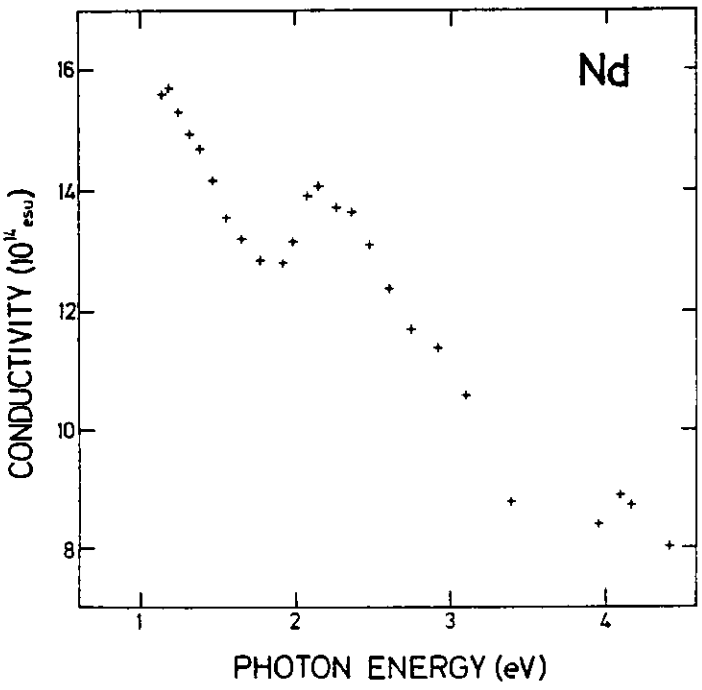

Fig. 43 Optical conductivity of Nd. Polycrystalline results by KN73.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Sm
FZG67	125-135	Trans		x				μ	absorption measurements
ZFG67	~50-500	Trans		x				μ	absorption measurements
HRS70	110-180	Trans		x			In	μ	absorption measurements with synchrotron radiation
KN70	1.13-3.96	Ellips				x	MP	$n,k,\sigma,\varepsilon_1,\mathrm{Im}(\varepsilon^{-1})$	measurements taken with N_2 gas
KN72	0.06-2.4	Ellips	80, 293, 460			x		n,k,σ,ε_1	
TC73	126-173			x				μ	energy loss spectroscopy
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	18-36	Trans	vapor	x				μ	absorption measurements of metal vapor with synchrotron radiation

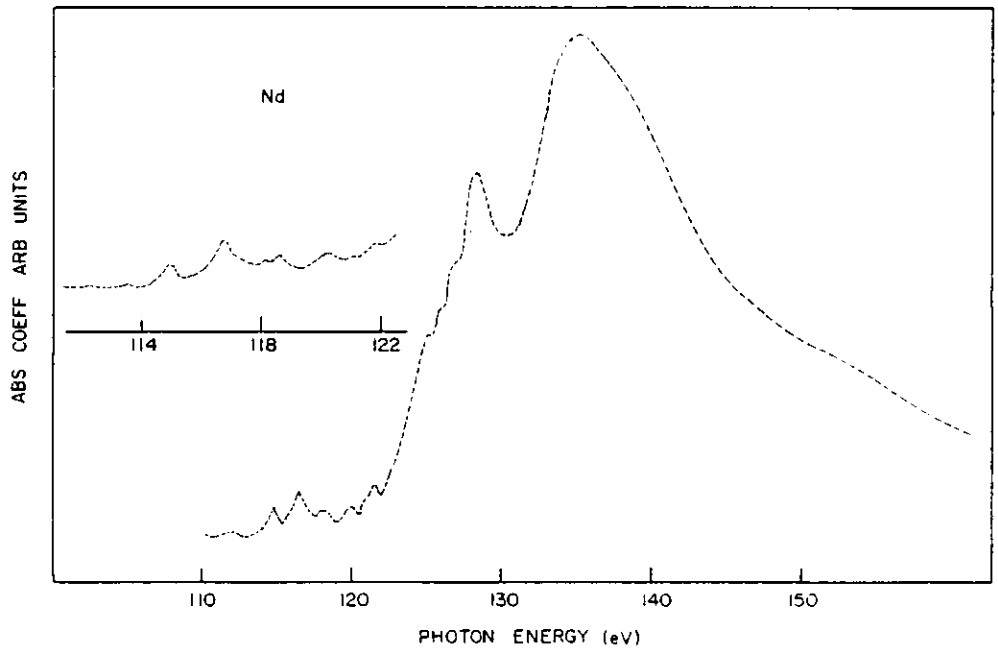

Fig. 45 Absorption coefficient of Nd for 110 ≤ hν ≤ 170 eV. Results by OL81.

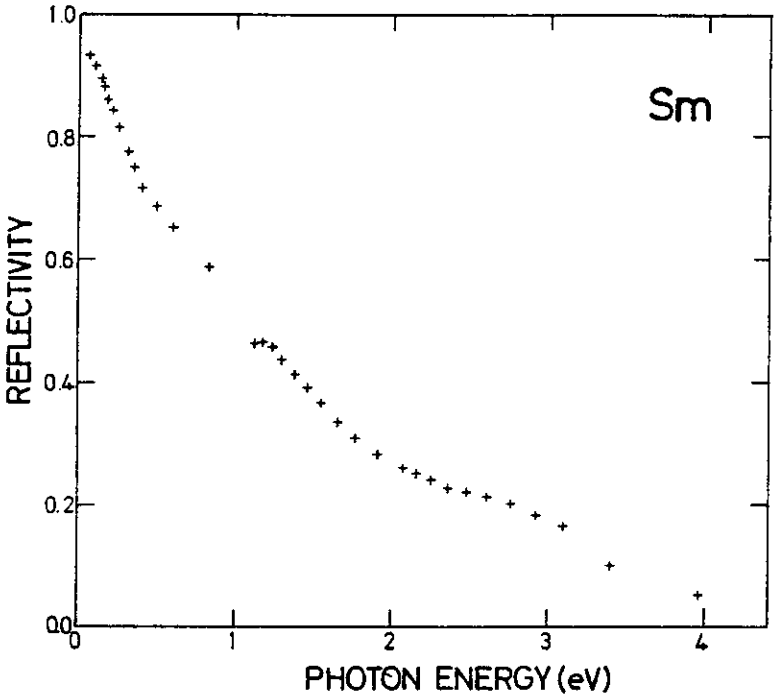

Fig. 47 Reflectivity of Sm. Polycrystalline results by KN70 and KN72.

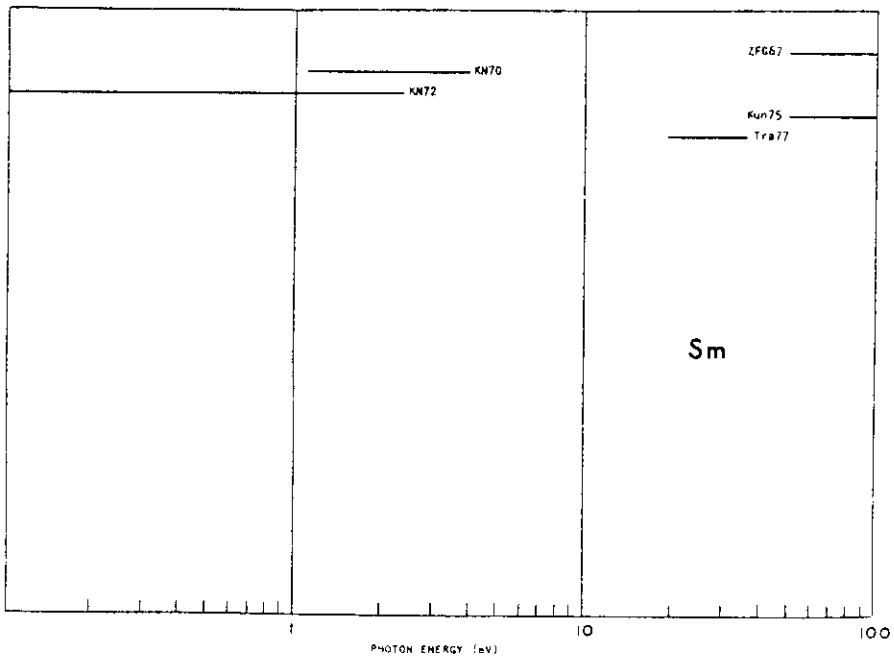

Fig. 46 Survey of available data on Sm.

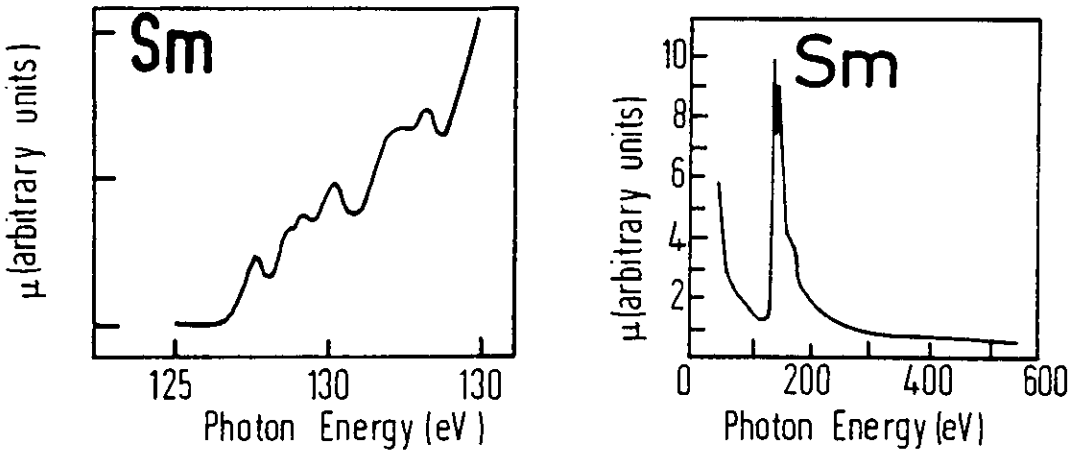

Fig. 49 Absorption coefficient of Sm. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

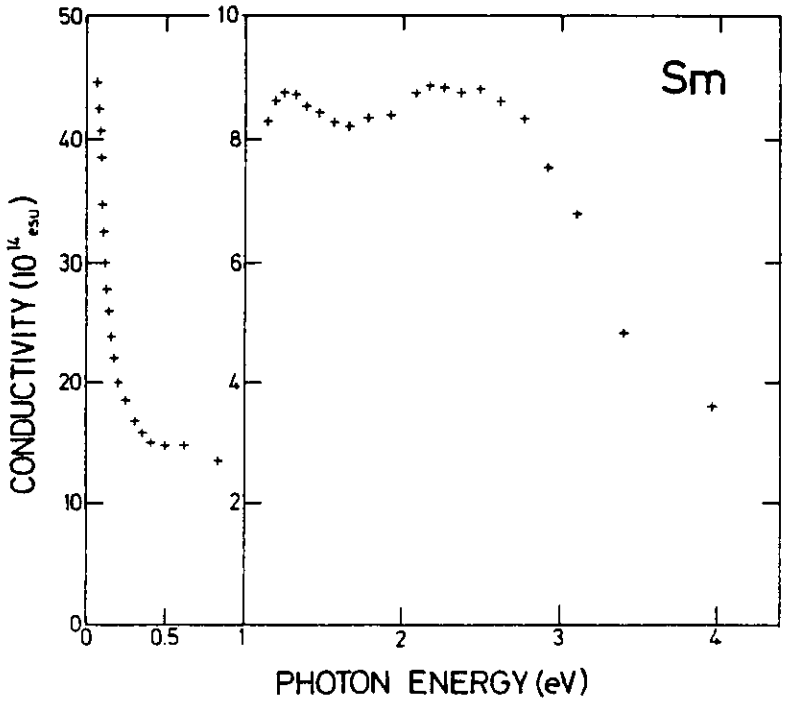

Fig. 48 Optical conductivity of Sm. Polycrystalline results by KN70 and KN72.

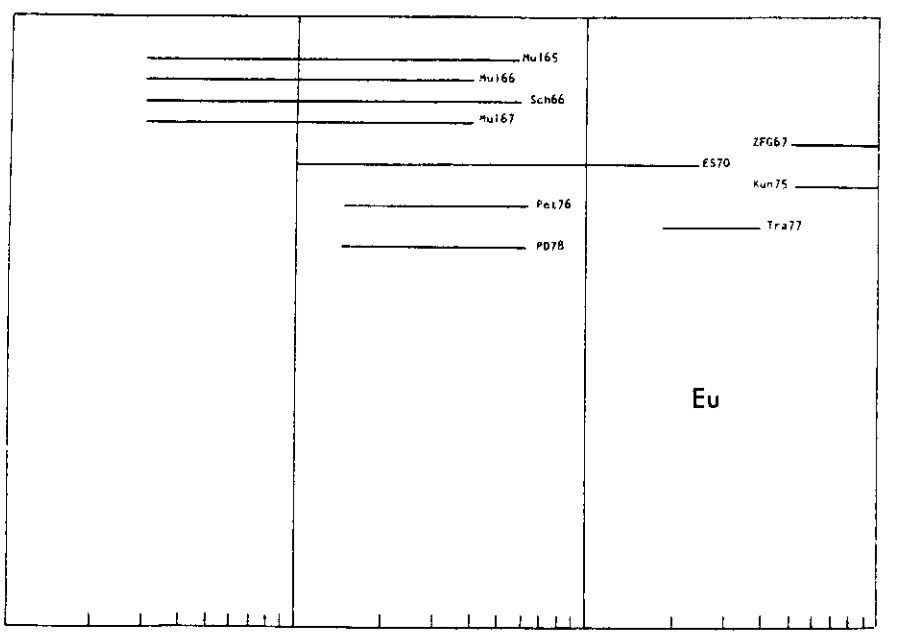

Fig. 50 Survey of available data on Eu.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Eu
Mu165	0.3-5	Refl		x				R	reflectance measured through sapphire window using existing n for sapphire
Mu166	0.3-4	Trans, Refl		x				σ	
Sch66	0.3-5	Trans, Refl		x				R	
FZG67	130-138	Trans		x				μ	absorption measurements
Mu167	0.3-4	Trans, Refl		x				R,T,ε_1,ε_2,σ	
ZFG67	∿50-560	Trans		x				μ	absorption measurements
ES70	1-11.6	Refl		x			In	R; KK: ε_1,ε_2,σ,μ $\mathrm{Im}(\varepsilon^{-1})$, $\mathrm{Im}(\varepsilon+1)^{-1}$	
TC73	130-180	Trans		x				μ	energy loss spectroscopy
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
Pet76	1.6-6.2	Trans, Refl		x				σ	
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	19-39		vapor	x				μ	absorption measurements of metal vapors with synchrotron radiation
PD78	1.6-6.2	Trans, Refl		x				R,σ	

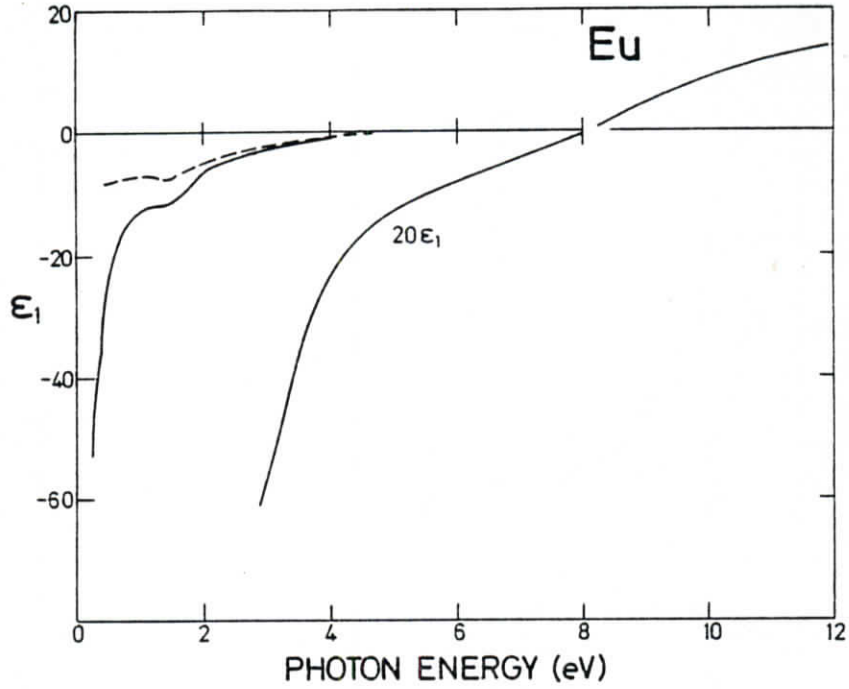

Fig. 52 ε_1 of Eu. Polycrystalline results by ES70 (——) and Mul67 (---).

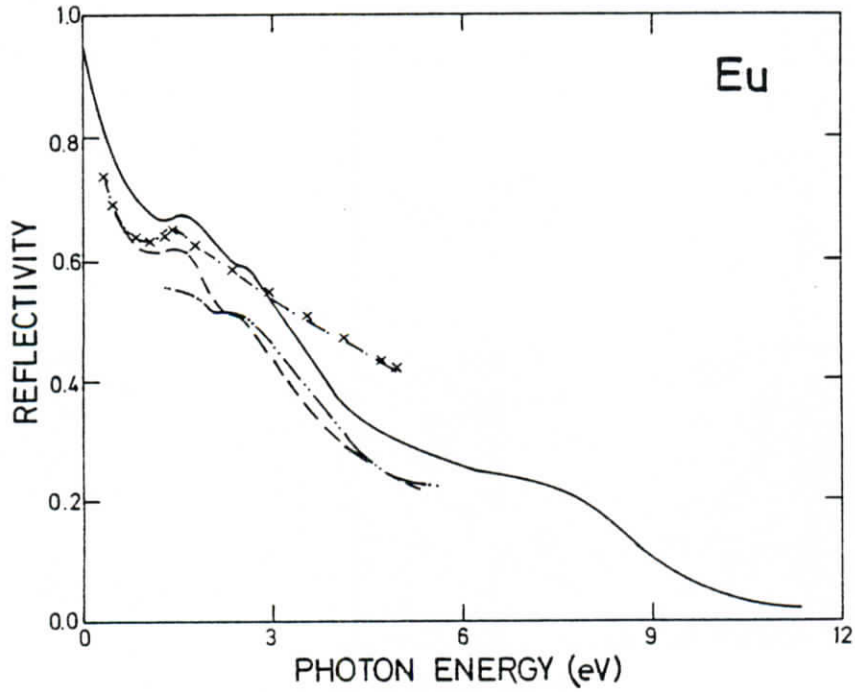

Fig. 51 Reflectivity of Eu. Polycrystalline results by ES70 (——); Mul67 (---); Mul65 (—·—); Sch66 (xxx); PD78 (—··—).

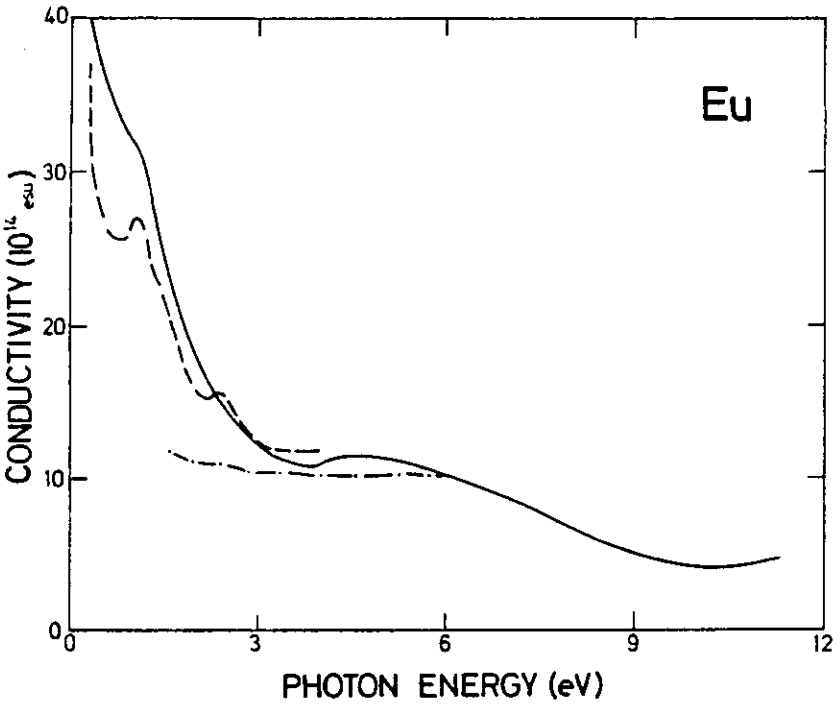

Fig. 54 Optical conductivity of Eu. Polycrystalline results by ES70 (——); Mu166 (---); PD78 (—·—).

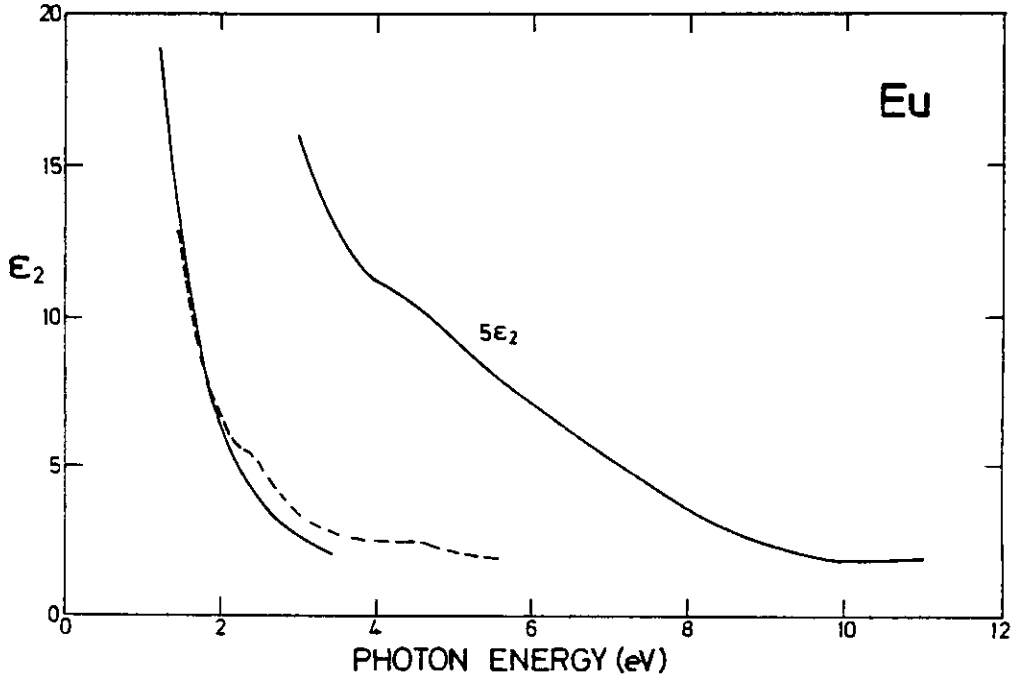

Fig. 53 ϵ_2 of Eu. Polycrystalline results by ES70 (——) and Mu167 (---).

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Gd
BSY66	1-11.8	Refl		x			In	R	uhv films
Sch66	0.3-4	Trans, Refl		x				σ	author confirms in private communication with HC (of HC69) that σ(ω) is too high
FZG67	137-146			x				μ	absorption measurements
ZFG67	∿50-560			x				μ	absorption measurements
HC69	0.5-5.6	Refl	105, 293	x				σ,T	
KN70	1.13-3.96	Ellips				x	MP	n,k,σ,ε_1,Im(ε^{-1})	measurements taken in N_2 gas
Dan71	2-50			x				Im(ε^{-1}),ε_1,ε_2,R,μ	energy loss spectroscopy
KN71	0.2-1.2	Ellips	80-460			x		σ	temperature varied
KnN71	0.06-1.24	Ellips	80, 293, 460			x		n,k	
Pet72	1.55-6.2	Trans, Refl		x				T,R,σ	
TRZ72	3-48					x		Im(ε^{-1})	energy loss spectroscopy
ErS73		Refl		x			In		magneto-optic Kerr rotation and ellipticity used to calculate magnetic contribution to the conductivity tensor
TC73	138-170			x				μ	energy loss spectroscopy
EBF74	1.5-5.5	Ellips		x			In	σ	uhv films
MJT74	1.8-3.1	Refl		x			In	R,n,k,σ	uhv films
KT75	0.35-2.5	Ellips	20-300	x				σ,ε_1	
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation

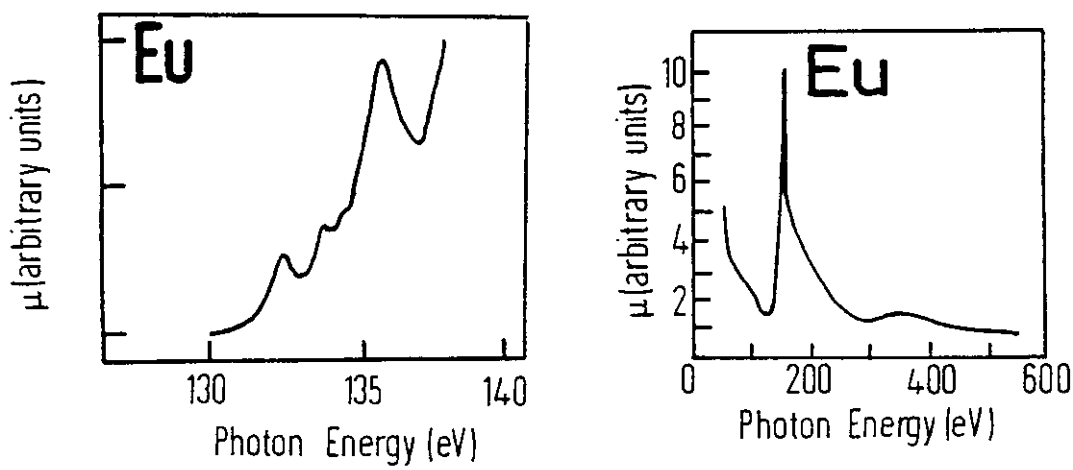

Fig. 55 Absorption coefficient of Eu. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

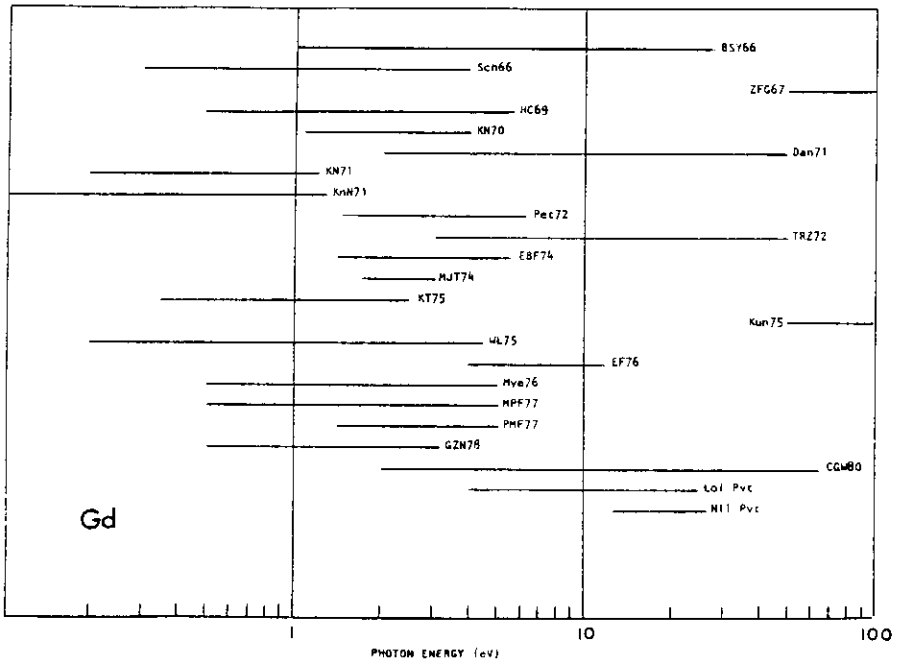

Fig. 56 Survey of available data on Gd.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Gd
WL75	0.2-4.4	Refl	4.2		x		EP	A; KK: σ for E $\perp$ c and E $\parallel$ c	plotted results extended to 5 eV with reflectivity measurements taken at room temperature; examined optical anisotropy
CGT76		Trans		x				$Im(\epsilon^{-1})$	energy loss spectroscopy
EF76	4-12			x			In	μ	absorption measurements
Mye76	0.5-5	Ellips	10, 100, 295	x				σ	uhv films
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
MPF77	0.5-5	Refl	10-300	x				R; n,k	
PMF77	1.5-5	Ellips	10-300	x				n,k,σ,ε_1	temperature varied
GZN78	0.5-3.1	Ellips	77-293			x	MP	σ	temperature varied
Lyn78									review paper
CGW80	~2-65			x				R,μ	fast electron energy loss spectroscopy
Loi Pvt	2-18	m-e		x			In	KK: ε_1,ε_2,σ,μ,R	
Nil Pvt	13-25	Trans		x				T	synchrotron radiation

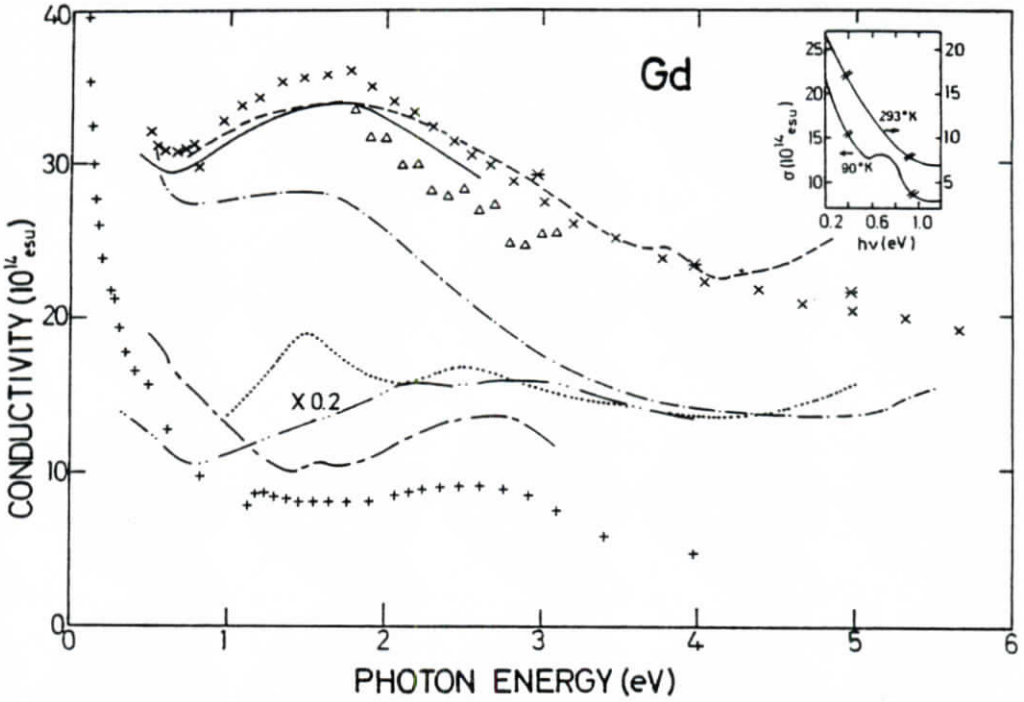

Fig. 58 Optical conductivity for Gd. Polycrystalline results by GZN78 (— - —); Sch66 (—·—); HC69 (xxx); EBF74 (—·—); PMF77 (···); Mye76 (---); MJT74 (ΔΔΔ); KN70 and KN71 (+++); KT75 (ooo); QLJ81 (***); KN77 (-++-) shown as inset.

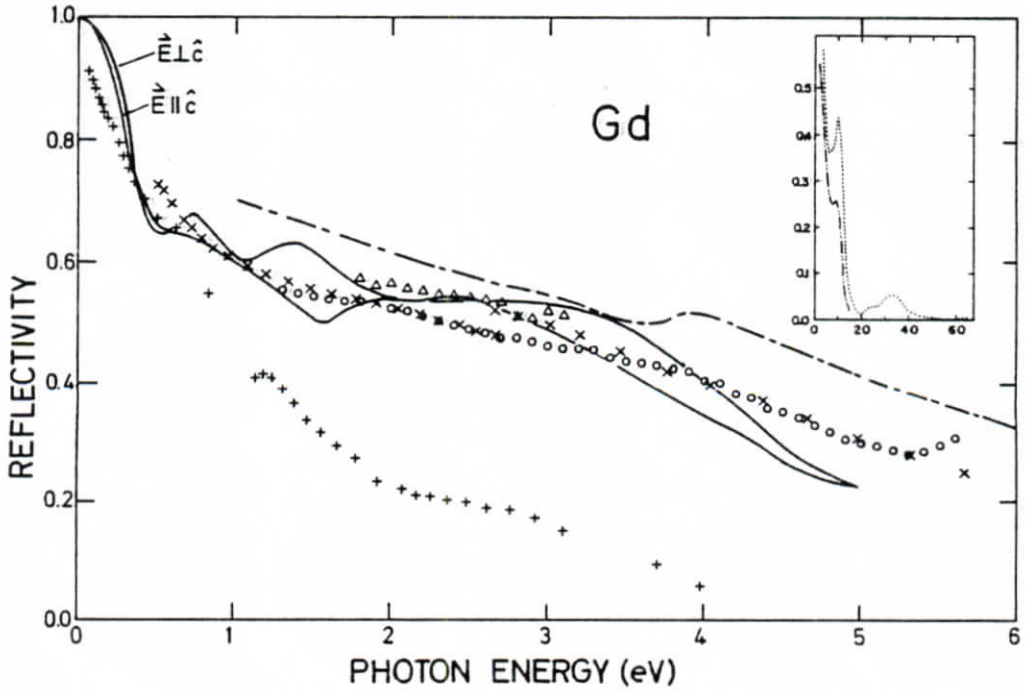

Fig. 57 Reflectivity of Gd. Single crystal results by WL75 (——) for $\vec{E}\parallel\hat{c}$ and $\vec{E}\perp\hat{c}$. Polycrystalline results by BSY66 (— - —); EBF74 (ooo); MJT74 (ΔΔΔ); KN70 and KN71 (+++); HC69 (xxx); and QLJ81 (—·—). Results by CGW80 (···) were derived from electron energy loss measurements.

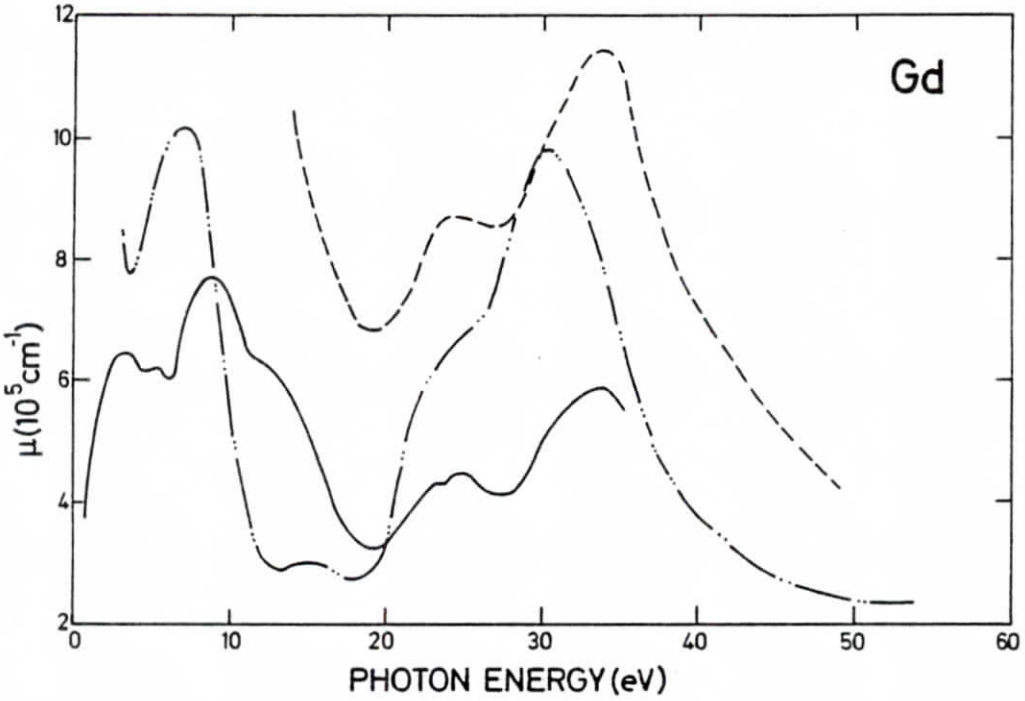

Fig. 60 Absorption coefficient for Gd for $0 \leq h\nu \leq 60$ eV. Polycrystalline results by EF76 (——); results of Dan71 (---) and CGW 80 (—·—) derived from electron energy loss measurements.

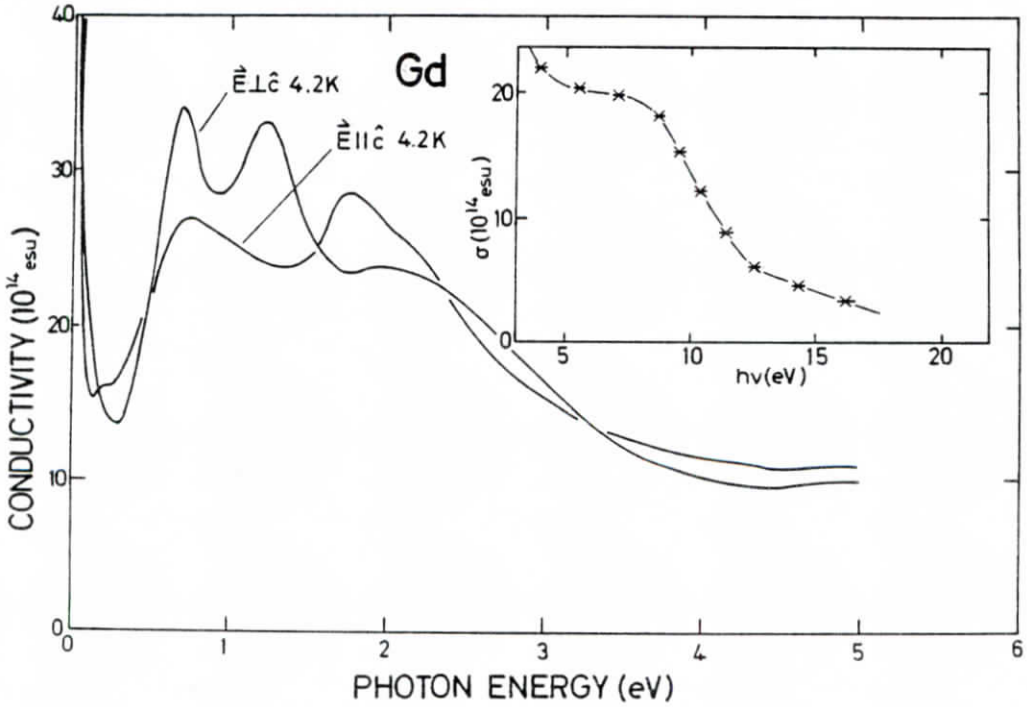

Fig. 59 Optical conductivity for Gd. Single crystal results by WL75 for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by QLG81 (***) shown as inset.

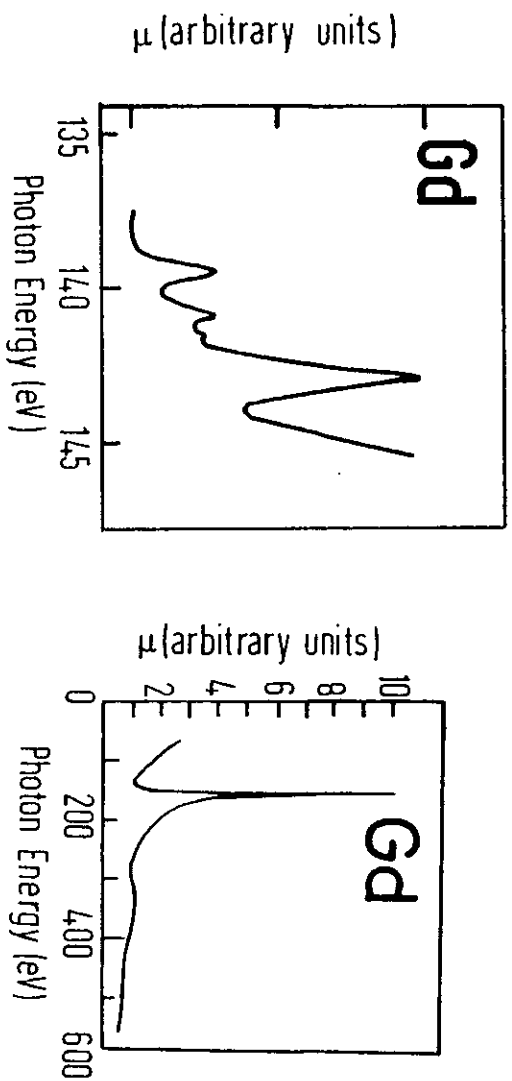

Fig. 61 Absorption coefficient of Gd. FZ667 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZF667 in the expanded energy range.

Gadolinium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975) based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\hat{\varepsilon}$)	R(ϕ=0)
0.06	-711.91	171.53	3.19	1.26	0.00	.112
0.10	-446.20	133.28	3.12	1.25	0.00	.107
0.12	-303.04	105.87	3.00	1.22	0.00	.099
0.14	-215.99	94.56	3.15	1.25	0.00	.106
0.16	-162.89	82.25	3.13	1.25	0.00	.107
0.18	-125.16	74.53	3.20	1.27	0.00	.112
0.20	-99.62	67.16	3.20	1.27	0.00	.112
0.22	-79.92	60.73	3.20	1.26	0.01	.112
0.24	-64.29	56.32	3.25	1.28	0.01	.116
0.26	-52.92	51.88	3.26	1.28	0.01	.116
0.28	-42.30	49.15	3.36	1.30	0.01	.123
0.30	-34.96	46.97	3.43	1.31	0.01	.128
0.32	-28.87	44.77	3.49	1.32	0.02	.132
0.34	-23.16	43.37	3.61	1.34	0.02	.139
0.36	-19.34	42.45	3.70	1.36	0.02	.145
0.38	-16.23	41.38	3.76	1.37	0.02	.150
0.40	-13.47	40.49	3.82	1.38	0.02	.154
0.42	-11.76	39.64	3.85	1.39	0.02	.156
0.44	-9.83	38.53	3.87	1.39	0.02	.157
0.46	-8.15	37.76	3.90	1.40	0.03	.160
0.48	-6.84	37.17	3.93	1.40	0.03	.162
0.50	-5.72	36.65	3.96	1.41	0.03	.163
0.52	-4.81	36.30	3.99	1.41	0.03	.165
0.54	-4.36	36.05	4.00	1.41	0.03	.166
0.56	-4.03	35.83	3.99	1.41	0.03	.165
0.58	-3.77	35.26	3.98	1.41	0.03	.165
0.60	-3.79	34.93	3.96	1.41	0.03	.163
0.62	-3.91	34.47	3.92	1.40	0.03	.161
0.64	-4.14	33.97	3.88	1.39	0.03	.158
0.66	-4.44	33.35	3.82	1.38	0.03	.154
0.68	-4.78	32.65	3.76	1.37	0.03	.150
0.70	-5.08	31.83	3.68	1.36	0.03	.145
0.72	-5.32	30.95	3.61	1.34	0.03	.140
0.74	-5.48	30.07	3.54	1.33	0.03	.135
0.76	-5.63	29.20	3.47	1.32	0.03	.130
0.78	-5.71	28.33	3.41	1.30	0.03	.126
0.80	-5.78	27.46	3.34	1.29	0.03	.121
0.84	-5.63	25.84	3.23	1.27	0.04	.114
0.88	-5.54	24.47	3.13	1.25	0.04	.107
0.92	-5.38	23.16	3.03	1.23	0.04	.101
0.96	-5.22	21.97	2.95	1.21	0.04	.095
1.00	-5.01	20.86	2.87	1.20	0.05	.090
1.05	-4.71	19.63	2.78	1.18	0.05	.085
1.10	-4.44	18.56	2.71	1.16	0.05	.080
1.15	-4.22	17.55	2.63	1.15	0.05	.075
1.20	-3.85	16.60	2.57	1.13	0.06	.071
1.25	-3.49	15.82	2.52	1.12	0.06	.068
1.30	-3.13	15.17	2.49	1.11	0.06	.066
1.35	-2.84	14.63	2.46	1.11	0.07	.065

Gd $\vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
1.40	-2.54	14.13	2.43	1.10	0.07	.063
1.45	-2.18	13.73	2.42	1.10	0.07	.063
1.50	-1.81	13.49	2.43	1.10	0.07	.063
1.52	-1.68	13.47	2.44	1.10	0.07	.064
1.54	-1.55	13.47	2.45	1.11	0.07	.064
1.56	-1.45	13.54	2.47	1.11	0.07	.065
1.58	-1.45	13.64	2.48	1.11	0.07	.066
1.60	-1.49	13.73	2.48	1.11	0.07	.066
1.65	-1.80	13.87	2.47	1.11	0.07	.065
1.70	-2.34	13.81	2.42	1.10	0.07	.062
1.75	-2.85	13.50	2.34	1.08	0.07	.058
1.80	-3.27	13.05	2.26	1.06	0.07	.053
1.85	-3.61	12.54	2.17	1.04	0.07	.049
1.90	-3.87	12.00	2.09	1.02	0.08	.045
1.95	-4.04	11.42	2.01	1.00	0.08	.040
2.00	-4.10	10.89	1.94	0.99	0.08	.037
2.05	-4.13	10.43	1.88	0.97	0.08	.035
2.10	-4.16	10.03	1.83	0.95	0.09	.032
2.15	-4.24	9.65	1.77	0.94	0.09	.030
2.20	-4.34	9.24	1.71	0.93	0.09	.028
2.25	-4.41	8.80	1.65	0.91	0.09	.025
2.30	-4.45	8.34	1.58	0.89	0.09	.023
2.35	-4.45	7.88	1.52	0.87	0.10	.021
2.40	-4.40	7.43	1.46	0.85	0.10	.019
2.45	-4.32	7.00	1.40	0.83	0.10	.018
2.50	-4.18	6.61	1.35	0.82	0.11	.016
2.60	-3.89	5.95	1.27	0.80	0.12	.015
2.70	-3.60	5.41	1.20	0.78	0.13	.014
2.80	-3.30	4.96	1.15	0.76	0.14	.013
2.90	-3.07	4.56	1.10	0.74	0.15	.013
3.00	-2.79	4.23	1.07	0.73	0.16	.013
3.10	-2.58	3.93	1.03	0.72	0.18	.012
3.20	-2.37	3.65	1.00	0.71	0.19	.012
3.30	-2.15	3.41	0.97	0.70	0.21	.012
3.40	-1.95	3.20	0.95	0.69	0.23	.013
3.50	-1.76	3.02	0.93	0.68	0.25	.013
3.60	-1.57	2.86	0.92	0.68	0.27	.013
3.70	-1.40	2.74	0.92	0.68	0.29	.013
3.80	-1.26	2.64	0.91	0.68	0.31	.013
3.90	-1.20	2.49	0.98	0.67	0.33	.013
4.00	-1.01	2.37	0.86	0.67	0.36	.013
4.10	-0.90	2.30	0.89	0.67	0.38	.013
4.20	-0.80	2.21	0.88	0.66	0.40	.013
4.30	-0.70	2.13	0.88	0.66	0.42	.013
4.40	-0.63	2.03	0.86	0.66	0.45	.013
4.50	-0.46	1.96	0.88	0.66	0.48	.013
4.60	-0.36	1.94	0.90	0.67	0.50	.013
4.80	-0.24	1.88	0.91	0.67	0.52	.013

Gadolinium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1978)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-593.73	163.42	3.32	1.29	0.00	.120
0.12	-409.71	124.33	3.04	1.24	0.00	.101
0.14	-298.33	99.91	2.85	1.19	0.00	.089
0.16	-225.37	83.05	2.72	1.17	0.00	.081
0.18	-174.96	71.51	2.65	1.15	0.00	.076
0.20	-138.97	62.01	2.57	1.13	0.00	.071
0.22	-111.59	54.49	2.51	1.12	0.00	.068
0.24	-90.20	48.53	2.47	1.11	0.00	.066
0.26	-72.98	43.64	2.45	1.11	0.01	.064
0.28	-58.55	40.22	2.50	1.12	0.01	.067
0.30	-46.61	37.60	2.58	1.13	0.01	.072
0.32	-36.06	36.77	2.74	1.18	0.01	.084
0.34	-28.20	36.33	2.98	1.22	0.02	.098
0.36	-21.24	36.59	3.25	1.27	0.02	.115
0.38	-16.52	37.10	3.47	1.32	0.02	.130
0.40	-12.71	37.41	3.66	1.35	0.02	.143
0.42	-9.86	37.60	3.81	1.39	0.02	.153
0.44	-7.32	37.51	3.93	1.40	0.03	.161
0.46	-4.96	37.49	4.05	1.42	0.03	.169
0.48	-2.81	37.72	4.18	1.45	0.03	.178
0.50	-1.02	38.30	4.32	1.47	0.03	.187
0.52	0.20	39.22	4.44	1.49	0.03	.195
0.54	0.80	40.25	4.53	1.51	0.02	.201
0.56	0.90	41.21	4.59	1.51	0.02	.205
0.58	0.42	42.06	4.61	1.52	0.02	.206
0.60	-0.45	42.53	4.59	1.51	0.02	.205
0.62	-1.46	42.67	4.54	1.51	0.02	.202
0.64	-2.64	42.61	4.47	1.50	0.02	.197
0.66	-4.16	42.35	4.38	1.48	0.02	.191
0.68	-5.83	41.53	4.25	1.46	0.02	.183
0.70	-7.30	40.20	4.10	1.43	0.02	.172
0.72	-8.56	38.53	3.93	1.40	0.02	.161
0.74	-9.42	36.54	3.76	1.37	0.03	.150
0.76	-9.77	34.44	3.61	1.34	0.03	.140
0.78	-9.63	32.47	3.48	1.32	0.03	.131
0.80	-9.12	30.83	3.39	1.30	0.03	.125
0.84	-8.10	28.47	3.28	1.28	0.03	.117
0.88	-6.98	26.74	3.21	1.27	0.04	.113
0.92	-6.04	25.59	3.18	1.26	0.04	.111
0.96	-5.49	24.70	3.15	1.25	0.04	.108
1.00	-4.63	23.97	3.15	1.25	0.04	.108
1.05	-4.11	23.77	3.16	1.26	0.04	.110
1.10	-4.34	23.76	3.15	1.25	0.04	.108
1.15	-5.08	23.50	3.08	1.24	0.04	.104
1.20	-6.04	22.64	2.97	1.22	0.04	.097
1.25	-7.07	21.78	2.81	1.19	0.04	.087
1.30	-7.86	20.35	2.64	1.15	0.04	.076
1.35	-8.40	18.68	2.46	1.11	0.04	.065
1.40	-8.36	16.98	2.30	1.07	0.05	.056

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Tb
Pet70	1.55-6.2	Trans, Refl		x				T,R,μ	
Pet72	1.55-4.96	Trans, Refl		x				T	
EBF74	1.5-5.5	Ellips		x			In	σ	
KN75	0.06-4.29	Ellips	80-450			x		n,k,σ	
KT75	0.35-2.5	Ellips	20-300	x				σ,ε_1	
WL75	0.2-4.4	Refl	4.2		x		EP	A; KK: σ for E⊥c and E‖c	absorptivity measured by calorimetry; observe optical anisostropy
CGT76	0.1-46	Trans		x				$Im(\varepsilon^{-1})$; KK: $\varepsilon_1,\varepsilon_2$	energy loss spectroscopy
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties

Gd E⊥c

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ω=0)
1.45	-8.06	15.54	4.17	1.04	0.05	.049
1.50	-7.59	14.39	4.08	1.02	0.05	.044
1.52	-7.50	13.92	4.04	1.01	0.05	.042
1.54	-7.19	13.44	4.01	1.00	0.06	.041
1.56	-6.96	13.14	3.99	1.00	0.06	.040
1.58	-6.72	12.84	3.97	0.99	0.06	.039
1.60	-6.44	12.59	3.96	0.99	0.06	.038
1.65	-6.06	12.03	3.92	0.98	0.07	.036
1.70	-5.66	11.52	3.89	0.97	0.07	.035
1.75	-5.27	11.12	3.88	0.97	0.07	.034
1.80	-4.97	10.82	3.86	0.96	0.08	.034
1.85	-4.76	10.56	3.85	0.96	0.08	.033
1.90	-4.63	10.30	3.83	0.96	0.08	.032
1.95	-4.52	10.04	3.80	0.95	0.08	.031
2.00	-4.46	9.78	3.77	0.94	0.08	.030
2.05	-4.40	9.52	3.74	0.94	0.09	.029
2.10	-4.37	9.25	3.71	0.93	0.09	.027
2.15	-4.33	8.98	3.68	0.92	0.09	.026
2.20	-4.32	8.72	3.64	0.91	0.09	.025
2.25	-4.32	8.45	3.61	0.90	0.09	.023
2.30	-4.32	8.17	3.57	0.89	0.10	.022
2.35	-4.32	7.88	3.53	0.87	0.10	.021
2.40	-4.30	7.59	3.49	0.86	0.10	.020
2.45	-4.28	7.30	3.45	0.85	0.10	.019
2.50	-4.24	7.01	3.41	0.84	0.10	.018
2.60	-4.15	6.46	3.33	0.81	0.11	.016
2.70	-4.04	5.93	3.25	0.79	0.12	.015
2.80	-3.90	5.44	3.18	0.77	0.12	.014
2.90	-3.76	4.97	3.11	0.75	0.13	.013
3.00	-3.59	4.51	3.04	0.72	0.14	.012
3.10	-3.38	4.09	2.98	0.70	0.15	.012
3.20	-3.16	3.71	2.93	0.68	0.16	.013
3.30	-2.91	3.38	2.88	0.66	0.17	.013
3.40	-2.67	3.09	2.84	0.65	0.19	.014
3.50	-2.42	2.85	2.81	0.64	0.20	.014
3.60	-2.18	2.65	2.79	0.63	0.23	.015
3.70	-1.95	2.49	2.78	0.62	0.25	.015
3.80	-1.76	2.35	2.77	0.62	0.27	.016
3.90	-1.58	2.22	2.76	0.62	0.30	.016
4.00	-1.40	2.11	2.75	0.61	0.33	.016
4.10	-1.24	2.01	2.75	0.61	0.36	.016
4.20	-1.09	1.92	2.75	0.61	0.39	.016
4.30	-0.94	1.85	2.75	0.61	0.43	.016
4.40	-0.79	1.78	2.76	0.62	0.47	.016
4.50	-0.63	1.75	2.78	0.63	0.51	.015
4.60	-0.53	1.75	2.81	0.63	0.52	.014
4.80	-0.39	1.69	2.82	0.64	0.56	.014
5.00	-0.24	1.64	2.84	0.65	0.60	.014

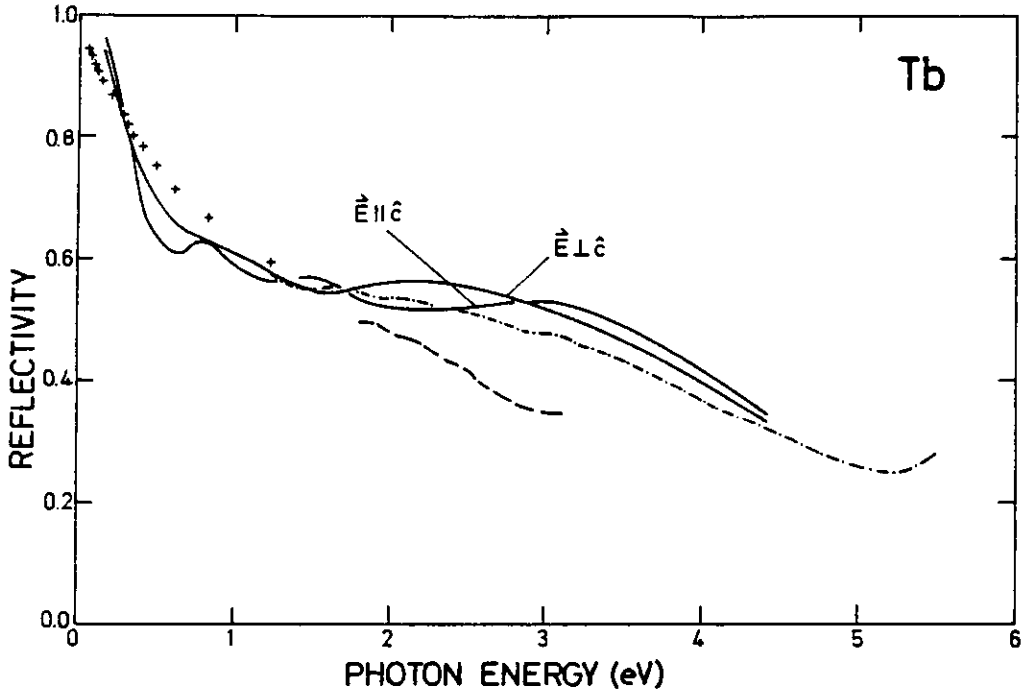

Fig. 63 Reflectivity for Tb. Single crystal results by WL75 for $\vec{E}\parallel\hat{c}$ and $\vec{E}\perp\hat{c}$; polycrystalline results by KN75 (+++); EBF74 (-·-); and MJT74 (---).

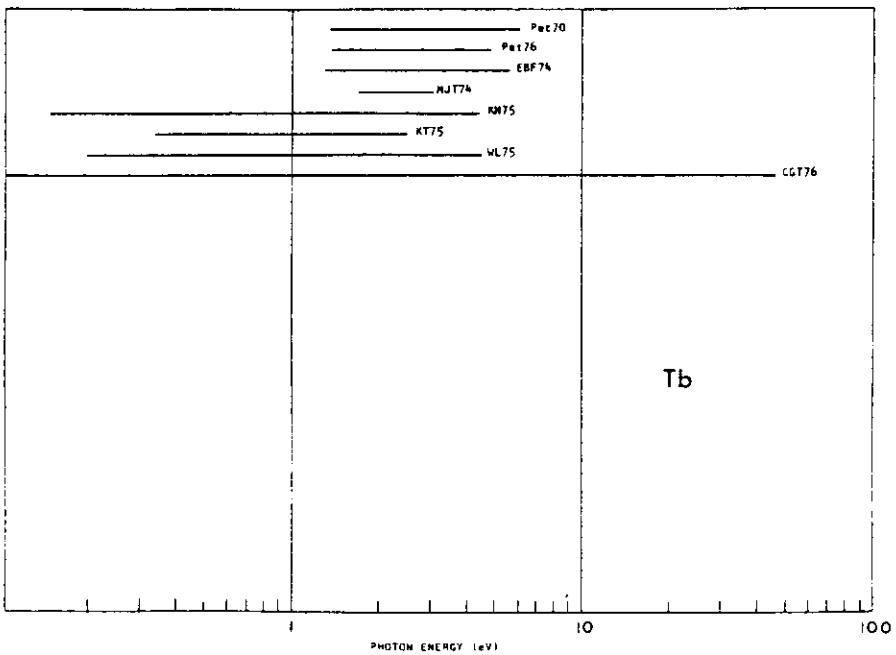

Fig. 62 Survey of available data on Tb.

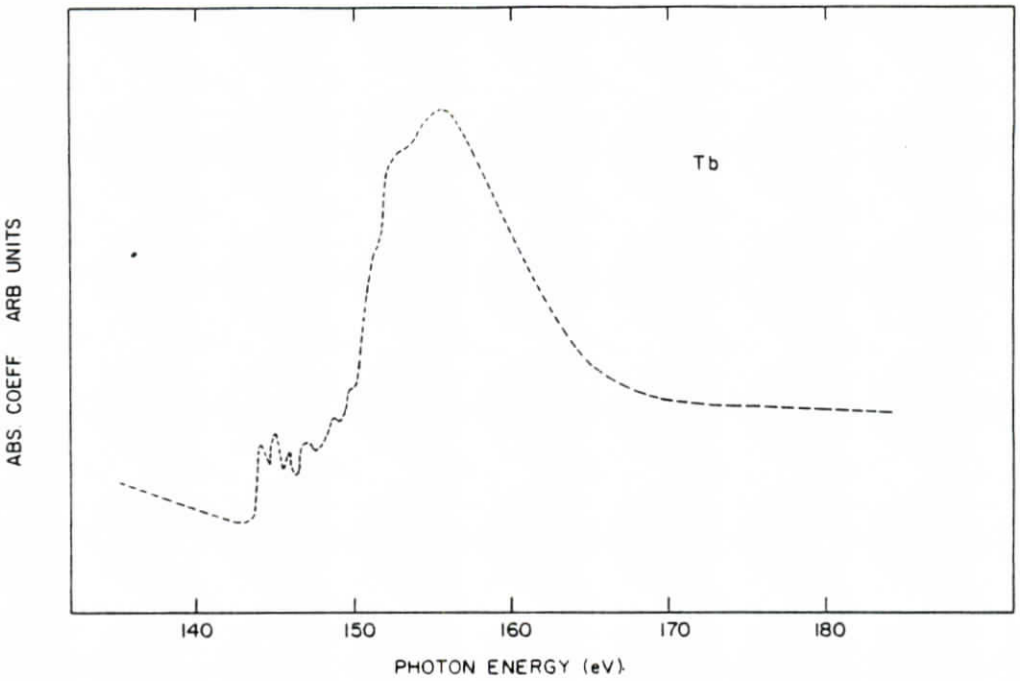

Fig. 65 Absorption coefficient of Tb for 130 ≤ hν ≤ 190 eV. Results by OL81.

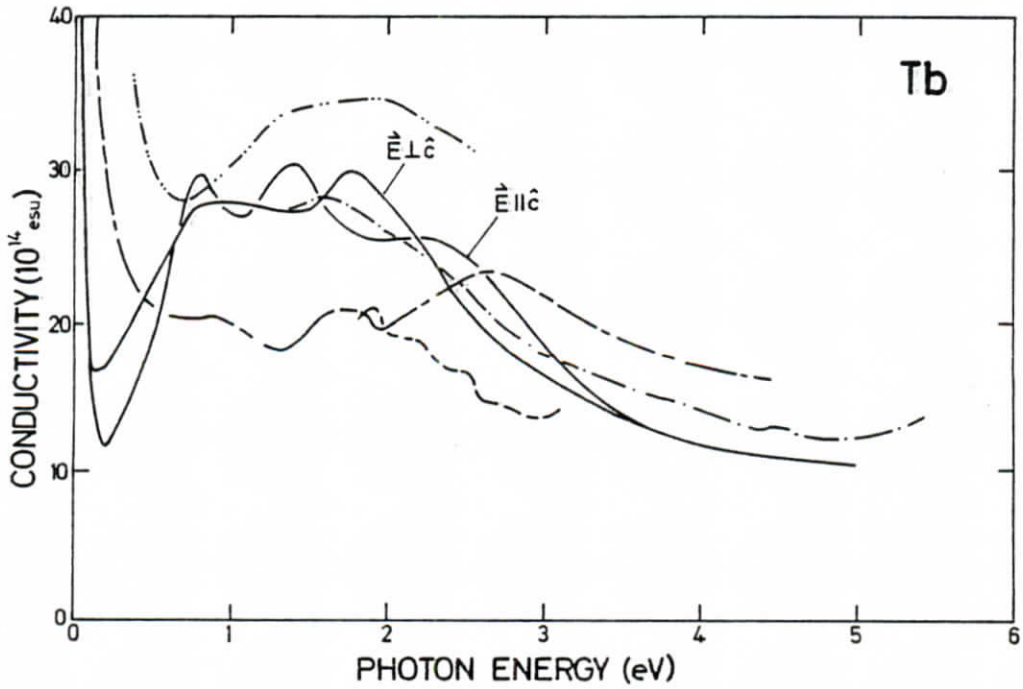

Fig. 64 Optical conductivity of Tb. Single crystal results by WL75 for $\vec{E}\parallel\hat{c}$ and $\vec{E}\perp\hat{c}$; polycrystalline results by KN75 (– – –); KT75 (—·—); MJT74 (---); and EBF74 (—·—).

Terbium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-553.96	146.83	3.09	1.24	0.00	.105
0.12	-375.09	115.10	2.94	1.21	0.00	.095
0.14	-267.96	98.77	2.97	1.22	0.00	.097
0.16	-200.42	86.90	3.00	1.23	0.00	.099
0.18	-154.51	77.70	3.04	1.23	0.00	.101
0.20	-121.62	70.26	3.07	1.24	0.00	.103
0.22	-96.90	64.92	3.14	1.25	0.00	.109
0.24	-78.42	61.54	3.26	1.28	0.01	.116
0.26	-65.37	57.70	3.30	1.29	0.01	.119
0.28	-54.31	54.19	3.35	1.29	0.01	.122
0.30	-44.97	51.89	3.44	1.31	0.01	.128
0.32	-38.11	50.14	3.53	1.33	0.01	.134
0.34	-33.00	48.13	3.56	1.33	0.01	.136
0.36	-28.37	46.17	3.59	1.34	0.02	.139
0.38	-24.52	44.41	3.62	1.35	0.02	.140
0.40	-21.05	42.93	3.66	1.35	0.02	.143
0.42	-18.16	41.79	3.70	1.36	0.02	.146
0.44	-15.98	40.78	3.73	1.37	0.02	.148
0.46	-14.03	39.80	3.75	1.37	0.02	.149
0.48	-12.68	38.84	3.75	1.37	0.02	.149
0.50	-11.15	37.81	3.76	1.37	0.02	.150
0.52	-9.98	37.06	3.77	1.37	0.03	.150
0.54	-9.17	36.25	3.76	1.37	0.03	.150
0.56	-8.15	35.36	3.75	1.37	0.03	.149
0.58	-7.44	34.76	3.75	1.37	0.03	.149
0.60	-6.86	34.10	3.74	1.37	0.03	.148
0.62	-6.31	33.45	3.72	1.36	0.03	.147
0.64	-5.82	32.91	3.71	1.36	0.03	.147
0.66	-5.57	32.41	3.70	1.36	0.03	.146
0.68	-5.31	31.82	3.67	1.35	0.03	.144
0.70	-5.03	31.30	3.65	1.35	0.03	.142
0.74	-4.90	30.40	3.60	1.34	0.03	.139
0.78	-5.03	29.33	3.52	1.33	0.03	.133
0.82	-5.13	28.07	3.42	1.31	0.03	.127
0.86	-5.10	26.80	3.33	1.29	0.04	.121
0.90	-4.99	25.63	3.25	1.27	0.04	.115
0.95	-4.91	24.34	3.16	1.26	0.04	.109
1.00	-4.89	23.10	3.06	1.24	0.04	.103
1.05	-4.71	21.90	2.97	1.22	0.04	.097
1.10	-4.60	20.87	2.90	1.20	0.05	.092
1.15	-4.44	19.90	2.82	1.19	0.05	.087
1.20	-4.34	19.04	2.76	1.17	0.05	.083
1.25	-4.21	18.21	2.69	1.16	0.05	.079
1.30	-4.06	17.45	2.63	1.15	0.05	.075
1.35	-3.91	16.76	2.58	1.14	0.06	.072
1.40	-3.72	16.14	2.53	1.13	0.06	.069
1.45	-3.54	15.61	2.50	1.12	0.06	.067
1.50	-3.31	15.18	2.47	1.11	0.06	.066
1.55	-3.11	14.92	2.46	1.11	0.06	.065

Tb $\vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
1.60	-3.10	14.80	2.45	1.11	0.06	.064
1.65	-3.27	14.69	2.43	1.10	0.06	.064
1.70	-3.59	14.47	2.38	1.09	0.07	.060
1.80	-4.26	13.70	2.25	1.06	0.07	.053
1.90	-4.78	12.67	2.09	1.02	0.07	.045
2.00	-5.07	11.56	1.94	0.99	0.07	.037
2.10	-5.20	10.50	1.81	0.95	0.08	.031
2.20	-5.19	9.50	1.68	0.92	0.08	.026
2.30	-5.11	8.57	1.56	0.88	0.09	.022
2.40	-4.94	7.73	1.45	0.85	0.09	.019
2.50	-4.70	6.99	1.36	0.83	0.10	.017
2.60	-4.45	6.34	1.28	0.80	0.11	.015
2.70	-4.16	5.76	1.21	0.78	0.11	.014
2.80	-3.86	5.29	1.16	0.76	0.12	.013
2.90	-3.60	4.88	1.11	0.75	0.13	.013
3.00	-3.33	4.53	1.07	0.73	0.14	.013
3.10	-3.12	4.21	1.03	0.72	0.15	.012
3.20	-2.90	3.93	1.00	0.71	0.16	.012
3.30	-2.70	3.66	0.96	0.69	0.18	.012
3.40	-2.50	3.42	0.93	0.68	0.19	.013
3.50	-2.31	3.19	0.90	0.67	0.21	.013
3.60	-2.11	3.00	0.88	0.66	0.22	.013
3.70	-1.94	2.84	0.87	0.66	0.24	.013
3.80	-1.78	2.69	0.85	0.65	0.26	.014
3.90	-1.62	2.56	0.84	0.65	0.28	.014
4.00	-1.48	2.43	0.83	0.64	0.30	.014
4.10	-1.35	2.32	0.82	0.64	0.32	.014
4.20	-1.20	2.22	0.81	0.64	0.35	.014
4.30	-1.08	2.14	0.81	0.64	0.37	.014
4.40	-0.97	2.08	0.81	0.64	0.39	.014
4.50	-0.91	2.00	0.80	0.63	0.41	.015
4.60	-0.80	1.92	0.80	0.63	0.44	.015
4.80	-0.63	1.80	0.80	0.63	0.49	.015
5.00	-0.46	1.71	0.81	0.64	0.55	.014

Terbium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.08	-890.29	211.17	3.51	1.33	0.00	.133
0.10	-570.18	141.55	2.94	1.21	0.00	.095
0.12	-392.59	104.63	2.62	1.14	0.00	.074
0.14	-285.49	84.20	2.47	1.11	0.00	.065
0.16	-215.42	66.08	2.23	1.05	0.00	.052
0.18	-164.36	55.40	2.13	1.03	0.00	.047
0.20	-127.29	48.13	2.10	1.02	0.00	.045
0.22	-99.45	44.39	2.17	1.04	0.00	.049
0.24	-78.99	42.07	2.29	1.07	0.01	.055
0.26	-63.58	40.29	2.42	1.10	0.01	.062
0.28	-51.71	39.20	2.57	1.13	0.01	.071
0.30	-42.97	37.45	2.65	1.15	0.01	.076
0.32	-35.31	35.70	2.73	1.17	0.01	.081
0.34	-28.60	34.43	2.84	1.19	0.02	.089
0.36	-22.90	33.70	2.99	1.22	0.02	.098
0.38	-18.48	33.09	3.12	1.25	0.02	.106
0.40	-14.31	32.79	3.28	1.28	0.03	.117
0.42	-11.37	32.85	3.42	1.31	0.03	.127
0.44	-9.16	32.74	3.52	1.33	0.03	.134
0.46	-7.26	32.43	3.60	1.34	0.03	.139
0.48	-5.52	32.09	3.68	1.36	0.03	.144
0.50	-3.95	31.87	3.75	1.37	0.03	.149
0.52	-2.66	31.82	3.83	1.38	0.03	.154
0.54	-1.75	31.80	3.88	1.39	0.03	.158
0.56	-0.89	31.69	3.93	1.40	0.03	.161
0.58	-0.20	31.69	3.97	1.41	0.03	.164
0.60	0.23	31.73	4.00	1.41	0.03	.166
0.62	0.71	31.69	4.03	1.42	0.03	.168
0.64	1.01	31.87	4.06	1.42	0.03	.170
0.66	1.03	32.10	4.07	1.43	0.03	.171
0.68	0.85	32.25	4.07	1.43	0.03	.171
0.70	0.51	32.33	4.05	1.42	0.03	.169
0.74	-0.54	32.20	3.98	1.41	0.03	.165
0.78	-2.22	31.55	3.83	1.38	0.03	.155
0.82	-3.73	29.67	3.63	1.35	0.03	.141
0.86	-4.42	27.72	3.44	1.31	0.04	.128
0.90	-4.44	25.73	3.29	1.28	0.04	.118
0.95	-4.04	23.80	3.17	1.26	0.04	.110
1.00	-3.62	22.33	3.08	1.24	0.04	.104
1.05	-3.04	21.16	3.03	1.23	0.05	.101
1.10	-2.49	20.39	3.00	1.23	0.05	.099
1.15	-2.18	19.96	2.99	1.22	0.05	.098
1.20	-2.17	19.67	2.97	1.22	0.05	.097
1.25	-2.37	19.36	2.93	1.21	0.05	.094
1.30	-2.73	18.98	2.87	1.20	0.05	.090
1.35	-3.17	18.49	2.79	1.18	0.05	.085
1.40	-3.70	17.88	2.70	1.16	0.05	.079
1.45	-4.19	17.08	2.59	1.14	0.05	.072
1.50	-4.56	16.15	2.47	1.11	0.06	.065

Tb $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
1.55	-4.71	15.14	2.36	1.09	0.06	.059
1.60	-4.61	14.20	2.27	1.07	0.06	.054
1.65	-4.38	13.44	2.21	1.05	0.07	.051
1.70	-4.17	12.66	2.16	1.04	0.07	.048
1.80	-3.82	11.92	2.09	1.02	0.08	.044
1.90	-3.57	11.22	2.03	1.01	0.08	.041
2.00	-3.47	10.63	1.96	0.99	0.09	.038
2.10	-3.35	10.14	1.91	0.98	0.09	.036
2.20	-3.50	9.68	1.84	0.96	0.09	.033
2.30	-3.60	9.13	1.76	0.94	0.09	.030
2.40	-3.70	8.59	1.68	0.92	0.10	.026
2.50	-3.80	8.01	1.59	0.89	0.10	.023
2.60	-3.85	7.43	1.50	0.87	0.11	.021
2.70	-3.87	6.85	1.41	0.84	0.11	.018
2.80	-3.86	6.28	1.33	0.81	0.12	.016
2.90	-3.81	5.71	1.24	0.79	0.12	.014
3.00	-3.70	5.11	1.14	0.76	0.13	.013
3.10	-3.46	4.58	1.07	0.73	0.14	.013
3.20	-3.19	4.17	1.01	0.71	0.15	.012
3.30	-2.96	3.82	0.97	0.70	0.16	.012
3.40	-2.71	3.51	0.93	0.68	0.18	.013
3.50	-2.47	3.25	0.90	0.67	0.20	.013
3.60	-2.24	3.03	0.87	0.66	0.21	.013
3.70	-2.04	2.86	0.86	0.66	0.23	.013
3.80	-1.86	2.69	0.84	0.65	0.25	.014
3.90	-1.68	2.54	0.83	0.64	0.27	.014
4.00	-1.52	2.41	0.82	0.64	0.30	.014
4.10	-1.36	2.30	0.81	0.64	0.32	.014
4.20	-1.22	2.19	0.80	0.63	0.35	.015
4.30	-1.09	2.10	0.80	0.63	0.38	.015
4.40	-0.97	2.02	0.80	0.63	0.40	.015
4.50	-0.84	1.95	0.80	0.63	0.43	.015
4.60	-0.74	1.90	0.81	0.63	0.46	.014
4.80	-0.57	1.79	0.81	0.64	0.51	.014
5.00	-0.40	1.70	0.82	0.64	0.56	.014

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Dy-2
WL75	0.2-4.4	Refl	4.2		x		EP	A; KK: σ for E⊥c and E∥c	absorptivity measured by calorimetry; examined optical anisotropy
CGT76		Trans		x					energy loss spectroscopy
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	20-39	Trans	vapor	x				μ	absorption measurements of atomic vapor with synchrotron radiation
Lyn78									review paper
CGW80	∿2-60			x				μ,R	fast electron energy loss spectroscopy
Loi Pvt	2-18	m-θ		x			In	KK: $\varepsilon_1,\varepsilon_2,\mu,\sigma$, R, $Im(\varepsilon^{-1})$	

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Dy-1
CR65	0.26-0.85	Trans	87-235	x				T	examined effect of magnetic ordering
FZG67	147-157	Trans		x				μ	absorption measurements
ZFG67	∿70-500	Trans		x				μ	absorption measurements
KN70	1.13-3.96	Ellips			x		MP	n,k,σ,ε_1,$Im(\varepsilon^{-1})$	measurements taken in N_2 gas
Dan71	∿1-50	Trans		x				$Im(\varepsilon^{-1})$,ε_1,ε_2,μ	energy loss spectroscopy
TRZ72	3-48	Refl				x		$Im(\varepsilon^{-1})$	energy loss spectroscopy
KnN73	0.06-1.24	Ellips	80, 293, 460			x		n,k,ε_1,$\varepsilon_2\omega$,σ	
TC73	147-175	Trans		x				μ	energy loss spectroscopy
EBF74	1.5-5.5	Ellips		x			In	σ	
KT75	0.35-2.5	Ellips	20-300	x				σ,ε_1	
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation

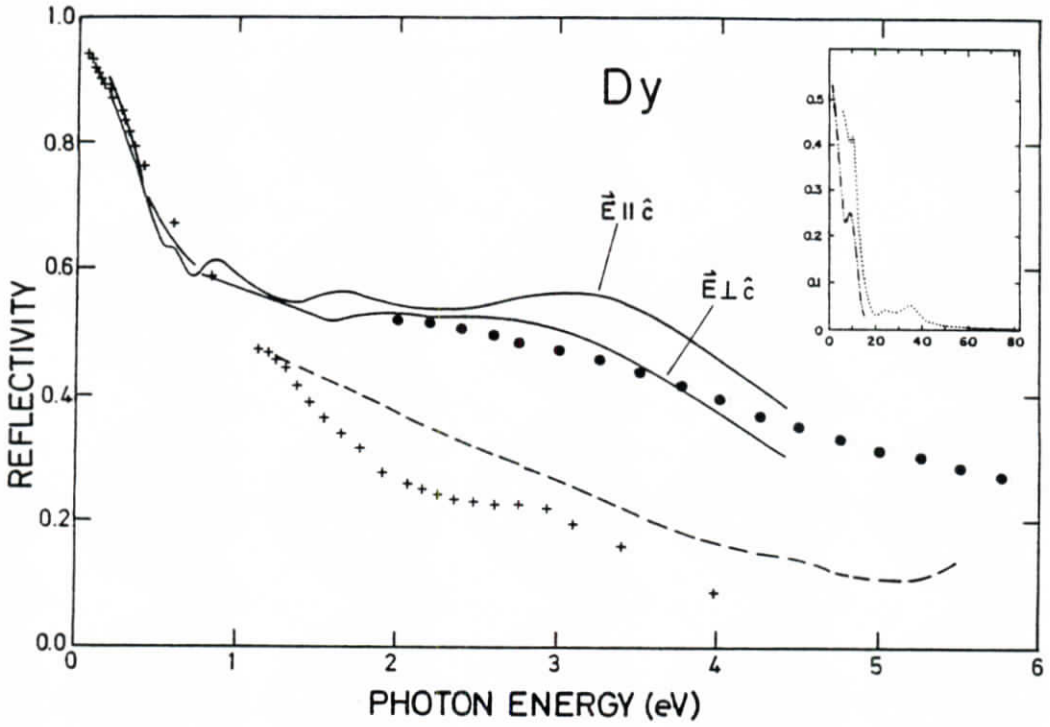

Fig. 67 Reflectivity of Dy. Single crystal results by WL75 for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$. Polycrystalline results by EBF74 (---), QLJ81 (••• and —·—); KN70, KnN73 (+++). The results shown in the inset by CGW80 (···) were derived from electron energy loss measurements.

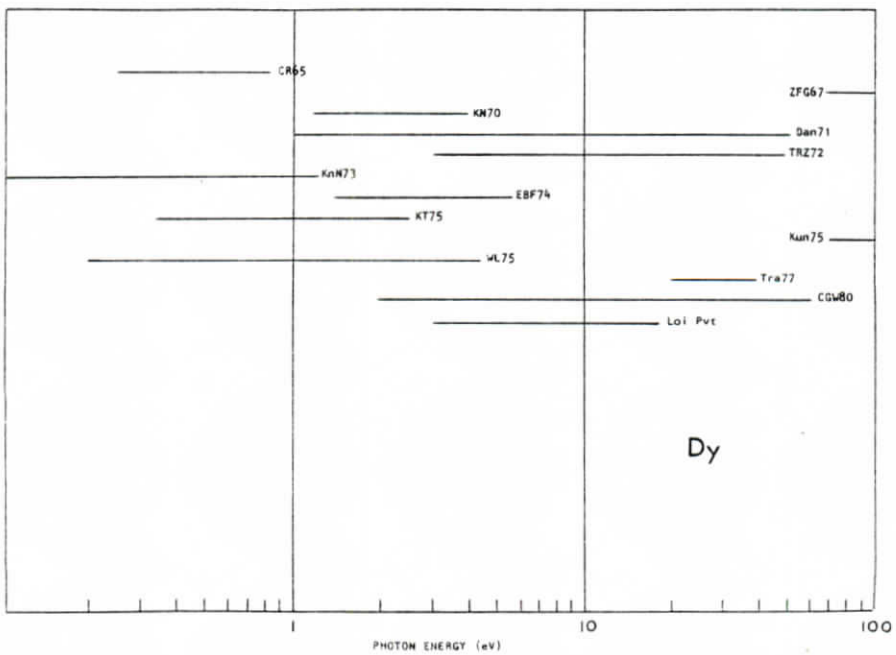

Fig. 66 Survey of available data on Dy.

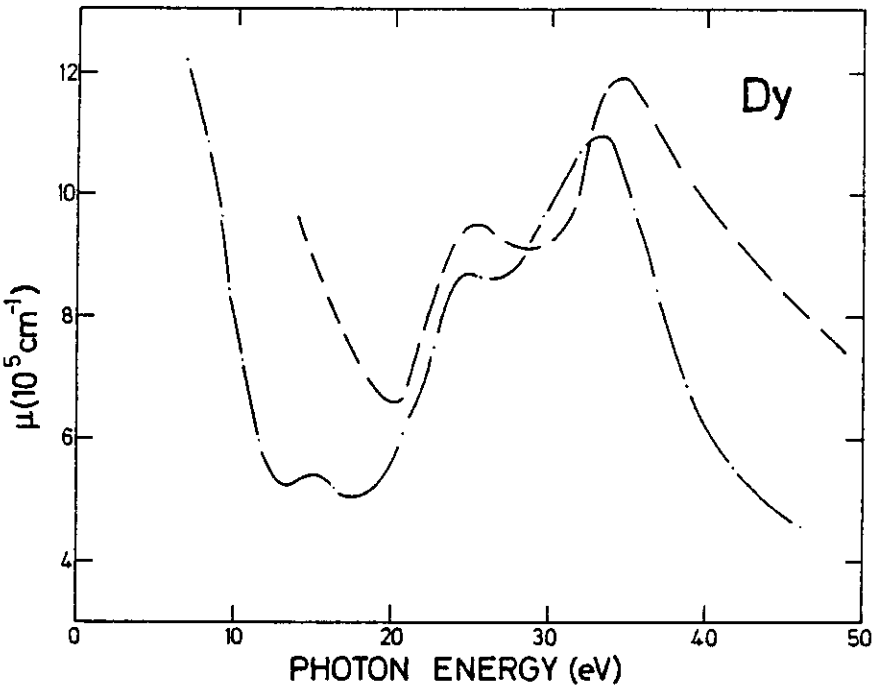

Fig. 69 Absorption coefficient for Dy for 5 ≤ hν ≤ 50 eV. Polycrystalline results by Dan71 (---) and CGW80 (-·-). Results of CGW80 were derived from electron energy loss measurements.

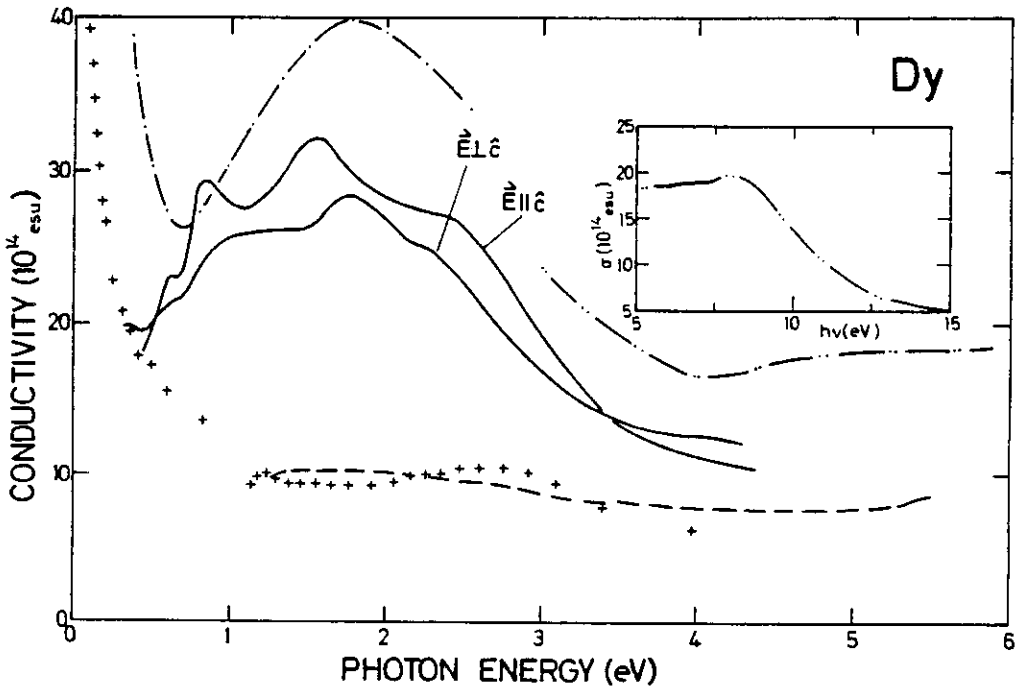

Fig. 68 Optical conductivity for Dy. Single crystal results by WL75 for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$. Polycrystalline results by EBF74 (---); KN70, KnN73 (+++); KT75 (—·—); and Loisel (pvt. comm. —··—).

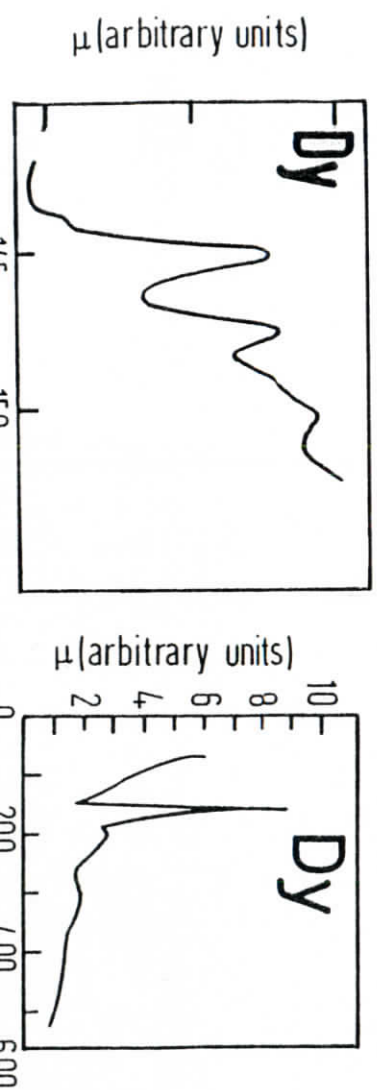

Fig. 70 Absorption coefficient of Dy. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

Dysprosium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975) based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.05	1844.97	351.38	43.15	4.64	0.00	.832
0.06	1255.67	219.92	35.57	4.22	0.00	.801
0.07	-890.81	152.19	2.54	1.13	0.00	.070
0.08	-654.75	132.00	2.57	1.13	0.00	.071
0.09	-499.80	118.85	2.64	1.15	0.00	.076
0.10	-393.72	116.89	2.91	1.21	0.00	.093
0.12	-264.09	96.56	2.92	1.21	0.00	.094
0.14	-182.12	93.80	3.37	1.30	0.00	.124
0.16	-135.88	90.58	3.70	1.36	0.00	.146
0.18	-107.83	83.07	3.76	1.37	0.00	.150
0.20	-86.20	76.05	3.79	1.38	0.01	.152
0.22	-70.05	70.85	3.85	1.39	0.01	.156
0.24	-59.10	64.92	3.79	1.38	0.01	.152
0.26	-48.35	60.91	3.84	1.38	0.01	.155
0.28	-41.56	57.70	3.84	1.39	0.01	.155
0.30	-36.36	54.11	3.80	1.38	0.01	.152
0.32	-31.43	51.06	3.76	1.37	0.01	.151
0.34	-28.25	47.94	3.70	1.36	0.02	.146
0.36	-24.45	45.05	3.66	1.35	0.02	.143
0.38	-21.57	42.81	3.63	1.35	0.02	.141
0.40	-19.34	40.48	3.57	1.34	0.02	.137
0.42	-16.76	38.34	3.54	1.33	0.02	.135
0.44	-14.70	36.61	3.52	1.33	0.02	.133
0.46	-12.64	35.03	3.51	1.32	0.03	.133
0.48	-10.55	33.97	3.54	1.33	0.03	.135
0.50	-9.47	33.24	3.54	1.33	0.03	.135
0.52	-8.29	32.29	3.54	1.33	0.03	.135
0.54	-7.43	31.50	3.53	1.33	0.03	.134
0.56	-6.65	30.64	3.51	1.33	0.03	.133
0.58	-5.91	29.83	3.50	1.32	0.03	.132
0.60	-5.13	29.18	3.50	1.32	0.03	.132
0.62	-4.90	28.64	3.48	1.32	0.03	.131
0.64	-4.46	27.78	3.44	1.31	0.04	.128
0.66	-3.98	27.04	3.42	1.31	0.04	.127
0.68	-3.59	26.32	3.39	1.30	0.04	.125
0.70	-2.91	25.59	3.38	1.30	0.04	.124
0.72	-2.33	25.18	3.39	1.30	0.04	.125
0.74	-1.85	24.91	3.40	1.30	0.04	.125
0.76	-1.59	24.72	3.40	1.30	0.04	.126
0.78	-1.38	24.48	3.40	1.30	0.04	.126
0.80	-1.27	24.27	3.39	1.30	0.04	.125
0.84	-1.21	23.77	3.36	1.30	0.04	.123
0.88	-1.27	23.19	3.31	1.29	0.04	.120
0.92	-1.28	22.63	3.27	1.28	0.04	.117
0.96	-1.88	22.05	3.18	1.26	0.05	.111
1.00	-1.70	20.97	3.11	1.25	0.05	.106
1.05	-1.78	20.26	3.05	1.23	0.05	.102
1.10	-1.84	19.45	2.97	1.22	0.05	.097
1.15	-1.91	18.72	2.91	1.21	0.05	.093

Dy $\vec{E} \parallel \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
1.20	-2.01	18.02	2.84	1.19	0.05	.088
1.25	-2.06	17.31	2.77	1.18	0.06	.084
1.30	-2.10	16.63	2.71	1.16	0.06	.080
1.35	-2.06	16.01	2.65	1.15	0.06	.077
1.40	-2.02	15.46	2.60	1.14	0.06	.074
1.45	-1.97	14.97	2.56	1.13	0.07	.071
1.50	-1.85	14.55	2.53	1.13	0.07	.069
1.55	-1.78	14.28	2.51	1.12	0.07	.068
1.60	-1.82	14.10	2.49	1.12	0.07	.067
1.65	-1.97	13.94	2.46	1.11	0.07	.065
1.70	-2.24	13.75	2.41	1.10	0.07	.062
1.75	-2.61	13.42	2.35	1.08	0.07	.059
1.80	-2.92	13.01	2.28	1.07	0.07	.055
1.85	-3.17	12.55	2.21	1.05	0.07	.051
1.90	-3.38	12.06	2.14	1.03	0.08	.047
1.95	-3.52	11.56	2.07	1.02	0.08	.043
2.00	-3.60	11.07	2.01	1.00	0.08	.040
2.05	-3.65	10.61	1.95	0.99	0.08	.037
2.10	-3.64	10.19	1.89	0.97	0.09	.035
2.15	-3.63	9.83	1.85	0.96	0.09	.033
2.20	-3.63	9.51	1.81	0.95	0.09	.031
2.25	-3.67	9.22	1.77	0.94	0.09	.030
2.30	-3.75	8.90	1.72	0.93	0.10	.028
2.35	-3.81	8.56	1.67	0.91	0.10	.026
2.40	-3.87	8.21	1.61	0.90	0.10	.024
2.45	-3.90	7.84	1.56	0.88	0.10	.022
2.50	-3.88	7.47	1.51	0.87	0.11	.021
2.55	-3.86	7.13	1.46	0.85	0.11	.019
2.60	-3.82	6.78	1.41	0.84	0.11	.018
2.65	-3.74	6.46	1.36	0.83	0.12	.017
2.70	-3.68	6.15	1.32	0.81	0.12	.016
2.75	-3.57	5.87	1.28	0.80	0.12	.015
2.80	-3.49	5.61	1.25	0.79	0.13	.015
2.85	-3.39	5.36	1.21	0.78	0.13	.014
2.90	-3.29	5.12	1.18	0.77	0.14	.014
2.95	-3.19	4.90	1.15	0.76	0.14	.013
3.00	-3.10	4.68	1.12	0.75	0.15	.013
3.10	-2.86	4.28	1.07	0.73	0.16	.013
3.20	-2.63	3.96	1.03	0.72	0.18	.012
3.30	-2.41	3.67	1.00	0.71	0.19	.012
3.40	-2.19	3.42	0.97	0.70	0.21	.012
3.50	-1.98	3.21	0.95	0.69	0.23	.013
3.60	-1.79	3.04	0.93	0.68	0.24	.013
3.70	-1.61	2.89	0.92	0.68	0.26	.013
3.80	-1.46	2.77	0.91	0.68	0.28	.013
3.90	-1.32	2.65	0.91	0.67	0.30	.013
4.00	-1.19	2.56	0.90	0.67	0.32	.013
4.10	-1.06	2.51	0.91	0.68	0.34	.013
4.20	-0.94	2.64	0.96	0.69	0.34	.012
4.30	-1.52	2.30	0.79	0.63	0.30	.015
4.40	-1.18	1.70	0.67	0.58	0.40	.020
4.50	-0.58	1.72	0.79	0.63	0.52	.015
4.60	-0.52	1.62	0.83	0.64	0.51	.014
4.80	-0.37	1.77	0.85	0.65	0.54	.014
5.00	-0.22	1.70	0.86	0.66	0.58	.013

Dysprosium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
0.06	1560.82	306.16	39.69	4.46	0.00	.820
0.07	1135.86	199.23	33.83	4.11	0.00	.792
0.08	-849.06	146.20	2.53	1.13	0.00	.069
0.09	-655.53	122.93	2.39	1.09	0.00	.061
0.10	-516.24	101.84	2.23	1.05	0.00	.052
0.12	-347.02	96.09	2.56	1.13	0.00	.071
0.14	-243.36	84.81	2.05	1.01	0.00	.043
0.16	-168.64	74.69	2.81	1.19	0.00	.046
0.18	-131.65	73.92	3.11	1.25	0.00	.106
0.20	-105.84	69.72	3.23	1.27	0.00	.114
0.22	-86.54	65.37	3.31	1.29	0.01	.119
0.24	-72.25	61.12	3.35	1.29	0.01	.122
0.26	-61.44	56.76	3.33	1.29	0.01	.121
0.28	-52.80	51.70	3.25	1.27	0.01	.115
0.30	-44.14	47.75	3.23	1.27	0.01	.114
0.32	-36.97	45.19	3.27	1.28	0.01	.117
0.34	-31.85	42.69	3.27	1.28	0.02	.117
0.36	-26.93	40.56	3.30	1.28	0.02	.119
0.38	-23.30	38.54	3.30	1.28	0.02	.119
0.40	-19.83	36.51	3.30	1.28	0.02	.118
0.42	-16.35	34.81	3.32	1.29	0.02	.120
0.44	-13.18	33.65	3.39	1.30	0.03	.125
0.46	-10.54	32.89	3.46	1.32	0.03	.130
0.48	-8.33	32.33	3.54	1.33	0.03	.135
0.50	-6.52	31.86	3.61	1.34	0.03	.140
0.52	-4.61	31.59	3.70	1.36	0.03	.146
0.54	-3.31	31.47	3.79	1.38	0.03	.152
0.56	-2.83	32.17	3.84	1.39	0.03	.155
0.58	-2.63	32.05	3.84	1.39	0.03	.155
0.60	-2.76	31.63	3.81	1.38	0.03	.153
0.62	-2.59	30.78	3.76	1.37	0.03	.150
0.64	-2.48	29.67	3.71	1.36	0.03	.146
0.66	-1.67	28.75	3.68	1.36	0.03	.145
0.68	-0.83	28.16	3.70	1.36	0.04	.146
0.70	0.06	27.75	3.73	1.37	0.04	.148
0.72	1.16	27.68	3.80	1.38	0.04	.152
0.74	1.83	28.30	3.89	1.39	0.04	.158
0.76	2.01	29.16	3.95	1.41	0.03	.163
0.78	1.18	30.09	3.96	1.41	0.03	.163
0.80	0.02	30.11	3.88	1.39	0.03	.158
0.84	-1.54	29.02	3.71	1.36	0.03	.146
0.88	-2.54	27.48	3.54	1.33	0.04	.135
0.92	-2.97	25.80	3.39	1.30	0.04	.125
0.96	-2.98	24.29	3.28	1.28	0.04	.117
1.00	-2.74	23.06	3.20	1.26	0.04	.112
1.05	-2.62	21.86	3.11	1.25	0.05	.106
1.10	-2.13	20.75	3.06	1.24	0.05	.103
1.15	-1.86	20.09	3.03	1.23	0.05	.101
1.20	-1.67	19.50	2.99	1.22	0.05	.099

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Ho
FZG67	153-162			x				μ	absorption measurements
ZFG67	60-520			x				μ	absorption measurements
BBS71	1-45			x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
Petr72	0.5-6.2	Trans, Refl		x				μ	
TC73	150-190			x				μ	energy loss spectroscopy
KT75	0.35-2.5	Ellips	20, 97, 300	x				σ,ε_1	
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
WL75	0.2-4.4	Refl	4.2		x		EP	A; σ	absorptivity measured by calorimetry
CGT76				x					energy loss spectroscopy
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	23-35		vapor	x				μ	absorption measurements of metal vapor with synchrotron radiation
Lyn78									review paper

Dy $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ω=0)
1.25	-1.53	19.03	2.96	1.22	0.05	.016
1.30	-1.50	18.67	2.94	1.21	0.05	.094
1.35	-1.52	18.37	2.91	1.21	0.05	.093
1.40	-1.65	18.19	2.88	1.20	0.05	.091
1.45	-2.05	18.04	2.84	1.19	0.05	.088
1.50	-2.63	17.71	2.76	1.18	0.06	.083
1.55	-3.14	17.17	2.68	1.16	0.06	.078
1.60	-3.66	16.52	2.57	1.13	0.06	.072
1.65	-4.02	15.71	2.47	1.11	0.06	.065
1.70	-4.14	14.92	2.38	1.09	0.06	.060
1.75	-4.19	14.24	2.31	1.07	0.06	.056
1.80	-4.20	13.65	2.24	1.06	0.07	.052
1.85	-4.20	13.09	2.18	1.05	0.07	.049
1.90	-4.18	12.59	2.13	1.03	0.07	.047
1.95	-4.17	12.13	2.08	1.02	0.07	.044
2.00	-4.13	11.71	2.04	1.01	0.08	.042
2.05	-4.12	11.32	1.99	1.00	0.08	.040
2.10	-4.09	10.93	1.95	0.99	0.08	.039
2.15	-4.05	10.58	1.91	0.98	0.08	.036
2.20	-3.99	10.29	1.88	0.97	0.08	.034
2.25	-3.99	10.05	1.85	0.96	0.09	.033
2.30	-4.02	9.81	1.81	0.95	0.09	.032
2.35	-4.10	9.56	1.78	0.94	0.09	.030
2.40	-4.20	9.31	1.73	0.93	0.09	.029
2.45	-4.30	9.01	1.69	0.92	0.09	.027
2.50	-4.40	8.70	1.64	0.90	0.09	.025
2.55	-4.48	8.37	1.58	0.89	0.09	.023
2.60	-4.55	8.03	1.53	0.87	0.09	.021
2.65	-4.61	7.66	1.47	0.86	0.10	.020
2.70	-4.61	7.30	1.42	0.84	0.10	.018
2.75	-4.62	6.94	1.36	0.83	0.10	.017
2.80	-4.59	6.59	1.31	0.81	0.10	.016
2.85	-4.53	6.26	1.26	0.80	0.10	.015
2.90	-4.47	5.94	1.22	0.78	0.11	.014
2.95	-4.39	5.62	1.17	0.77	0.11	.014
3.00	-4.30	5.33	1.13	0.75	0.11	.013
3.10	-4.10	4.78	1.05	0.72	0.12	.012
3.20	-3.85	4.26	0.98	0.70	0.13	.012
3.30	-3.58	3.84	0.91	0.68	0.14	.013
3.40	-3.29	3.46	0.86	0.66	0.15	.013
3.50	-2.98	3.16	0.83	0.64	0.17	.014
3.60	-2.70	2.92	0.80	0.63	0.18	.015
3.70	-2.44	2.72	0.78	0.62	0.20	.015
3.80	-2.21	2.56	0.77	0.62	0.22	.016
3.90	-2.00	2.42	0.75	0.61	0.25	.016
4.00	-1.82	2.30	0.75	0.61	0.27	.016
4.10	-1.65	2.19	0.74	0.61	0.29	.017
4.20	-1.49	2.09	0.73	0.61	0.32	.017
4.30	-1.35	2.00	0.73	0.60	0.34	.017
4.40	-1.20	1.93	0.73	0.61	0.37	.017
4.50	-1.10	1.85	0.73	0.60	0.40	.017
4.60	-0.98	1.78	0.73	0.60	0.43	.017
4.80	-0.77	1.67	0.73	0.60	0.49	.017
5.00	-0.60	1.56	0.73	0.60	0.56	.017

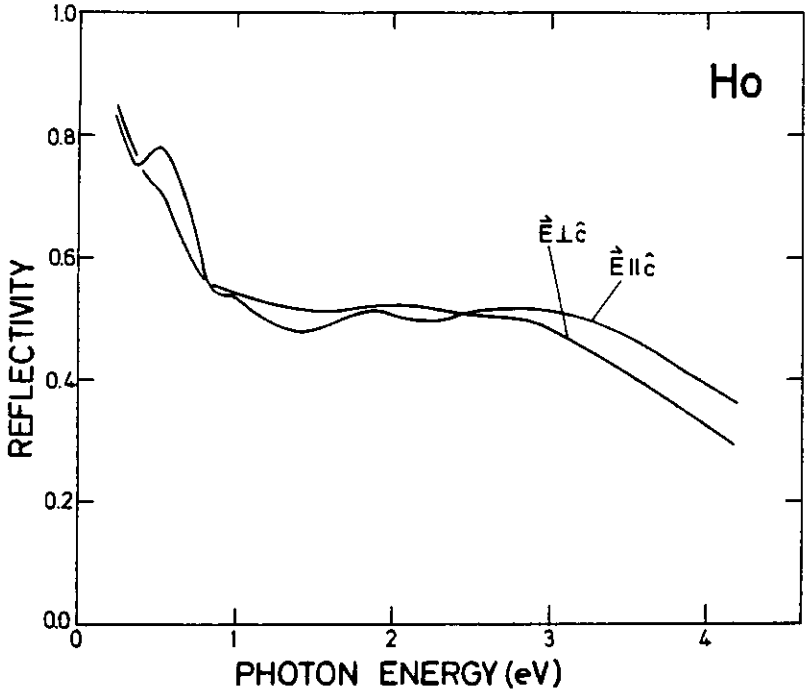

Fig. 72 Reflectivity of Ho. Single crystal results by WL75 (——) for $\vec{E}\parallel\hat{c}$ and $\vec{E}\perp\hat{c}$.

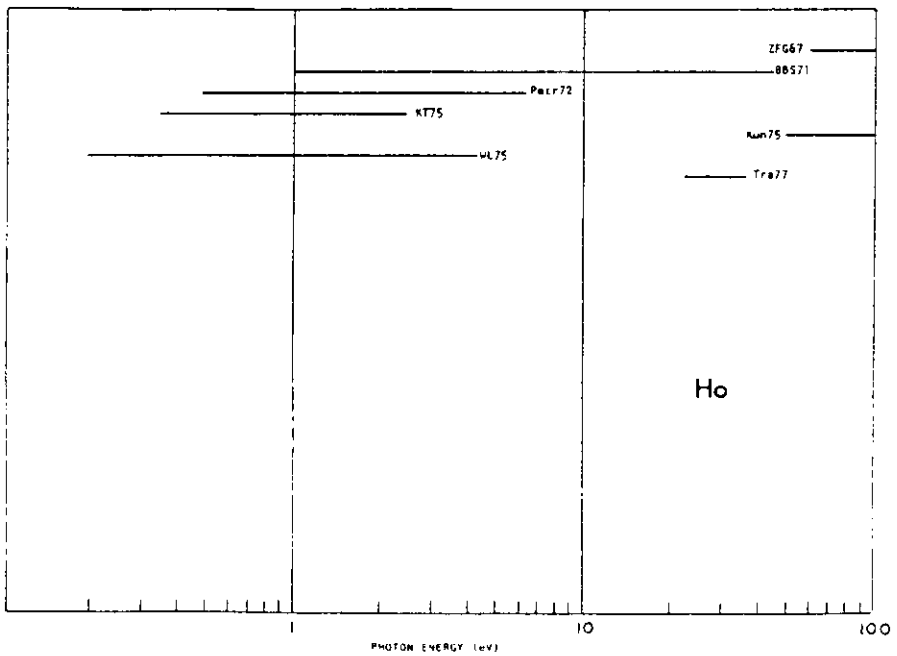

Fig. 71 Survey of available data on Ho.

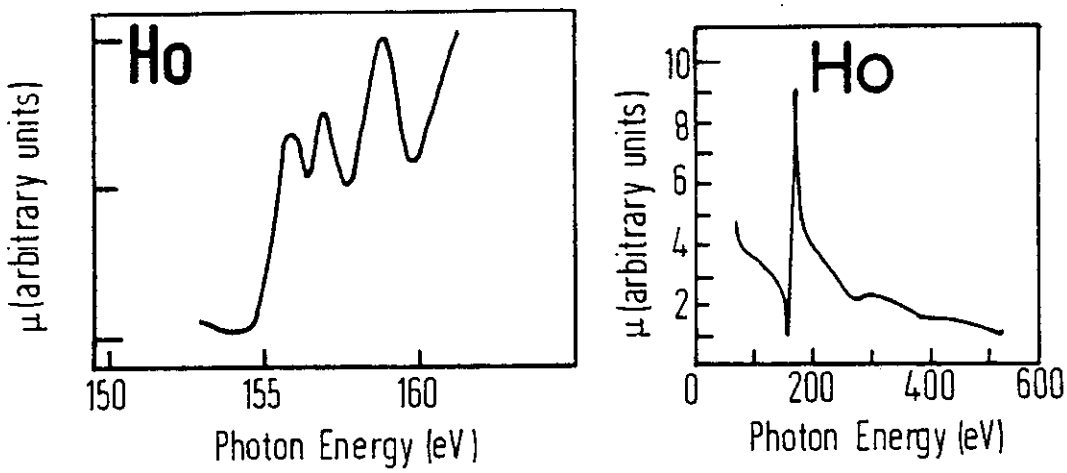

Fig. 74 Absorption coefficient of Ho. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

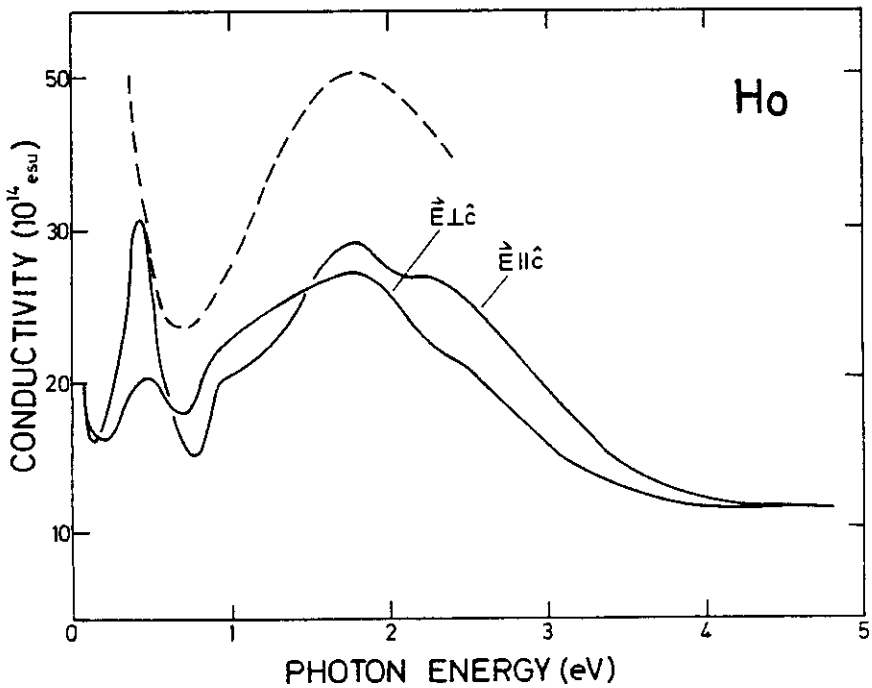

Fig. 73 Optical conductivity for Ho. Single crystal results by WL75 (——) for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by KT75 (---).

Holmium single crystal with $\vec{E} \| \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.02	1504.79	532.95	39.38	4.44	0.00	.818
0.04	3174.43	806.32	56.79	5.33	0.00	.870
0.06	1394.31	315.06	37.58	4.33	0.00	.811
0.08	-766.91	192.29	3.45	1.31	0.00	.128
0.10	-480.90	143.23	3.23	1.27	0.00	.114
0.12	-328.31	116.15	3.16	1.26	0.00	.109
0.14	-238.01	99.66	3.16	1.26	0.00	.110
0.16	-180.75	85.56	3.10	1.25	0.00	.105
0.18	-140.46	74.84	3.06	1.24	0.00	.103
0.20	-111.24	67.17	3.06	1.24	0.00	.103
0.22	-89.60	60.32	3.03	1.23	0.01	.101
0.24	-71.91	56.54	3.13	1.25	0.01	.107
0.26	-59.34	53.58	3.21	1.27	0.01	.113
0.28	-49.54	51.25	3.30	1.28	0.01	.119
0.30	-42.21	49.21	3.36	1.30	0.01	.123
0.32	-36.53	47.11	3.40	1.30	0.01	.125
0.34	-31.64	45.36	3.44	1.31	0.01	.128
0.36	-28.07	43.71	3.46	1.31	0.02	.129
0.38	-24.86	42.23	3.47	1.32	0.02	.131
0.40	-22.60	40.88	3.47	1.32	0.02	.130
0.42	-20.72	39.47	3.45	1.31	0.02	.129
0.44	-19.29	38.06	3.42	1.31	0.02	.127
0.46	-18.16	36.51	3.36	1.30	0.02	.123
0.48	-17.03	34.94	3.30	1.29	0.02	.119
0.50	-16.15	33.38	3.24	1.27	0.02	.114
0.52	-15.27	31.73	3.16	1.26	0.03	.109
0.54	-14.31	30.17	3.09	1.24	0.03	.105
0.56	-13.57	28.56	3.00	1.23	0.03	.099
0.58	-12.46	26.94	2.93	1.21	0.03	.094
0.60	-11.32	25.59	2.89	1.20	0.03	.091
0.62	-10.21	24.40	2.85	1.19	0.03	.089
0.64	-9.15	23.31	2.82	1.19	0.04	.087
0.66	-7.97	22.39	2.81	1.19	0.04	.086
0.68	-6.98	21.61	2.80	1.18	0.04	.086
0.70	-5.77	20.93	2.82	1.19	0.04	.087
0.72	-4.69	20.56	2.86	1.20	0.05	.090
0.74	-3.71	20.39	2.92	1.21	0.05	.093
0.76	-2.99	20.39	2.97	1.22	0.05	.097
0.78	-2.49	20.42	3.01	1.23	0.05	.099
0.80	-2.13	20.43	3.03	1.23	0.05	.101
0.82	-1.89	20.41	3.05	1.23	0.05	.102
0.84	-1.79	20.34	3.05	1.24	0.05	.102
0.86	-1.66	20.16	3.05	1.23	0.05	.102
0.88	-1.57	20.00	3.04	1.23	0.05	.101
0.90	-1.51	19.80	3.03	1.23	0.05	.101
0.92	-1.47	19.59	3.01	1.23	0.05	.100
0.94	-1.39	19.35	3.00	1.22	0.05	.099
0.96	-1.36	19.13	2.98	1.22	0.05	.098
0.98	-1.30	18.88	2.97	1.22	0.05	.097

Ho $\vec{E} \| \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
1.00	-1.23	18.65	2.95	1.22	0.05	.096
1.05	-1.13	18.16	2.92	1.21	0.05	.094
1.10	-1.12	17.69	2.88	1.20	0.06	.091
1.15	-1.11	17.22	2.84	1.19	0.06	.089
1.20	-1.17	16.80	2.80	1.18	0.06	.086
1.25	-1.23	16.37	2.76	1.17	0.06	.083
1.30	-1.35	15.98	2.71	1.16	0.06	.080
1.35	-1.48	15.57	2.66	1.15	0.06	.077
1.40	-1.60	15.16	2.61	1.14	0.07	.074
1.45	-1.74	14.77	2.56	1.13	0.07	.071
1.50	-1.85	14.37	2.51	1.12	0.07	.068
1.55	-1.96	14.02	2.47	1.11	0.07	.065
1.60	-2.07	13.71	2.43	1.10	0.07	.063
1.65	-2.24	13.44	2.39	1.09	0.07	.060
1.70	-2.46	13.15	2.34	1.08	0.07	.059
1.75	-2.74	12.83	2.28	1.07	0.07	.054
1.80	-2.99	12.45	2.22	1.05	0.08	.051
1.85	-3.28	12.05	2.15	1.04	0.08	.047
1.90	-3.51	11.57	2.07	1.02	0.08	.043
1.95	-3.70	11.06	2.00	1.00	0.08	.040
2.00	-3.85	10.56	1.92	0.98	0.08	.036
2.05	-3.92	10.05	1.85	0.96	0.09	.033
2.10	-3.93	9.57	1.79	0.95	0.09	.031
2.15	-3.95	9.11	1.73	0.93	0.09	.028
2.20	-3.90	8.67	1.67	0.92	0.10	.026
2.30	-3.74	7.93	1.59	0.89	0.10	.023
2.40	-3.58	7.36	1.52	0.87	0.11	.021
2.50	-3.56	6.62	1.44	0.85	0.12	.019
2.60	-3.53	6.24	1.35	0.82	0.12	.016
2.70	-3.41	5.67	1.27	0.80	0.13	.015
2.80	-3.25	5.13	1.19	0.77	0.14	.014
2.90	-3.04	4.65	1.12	0.75	0.15	.013
3.00	-2.79	4.24	1.07	0.73	0.16	.013
3.10	-2.54	3.89	1.03	0.72	0.18	.012
3.20	-2.29	3.62	1.00	0.71	0.20	.012
3.30	-2.09	3.37	0.97	0.70	0.21	.012
3.40	-1.89	3.16	0.95	0.69	0.23	.013
3.50	-1.69	2.96	0.93	0.68	0.25	.013
3.60	-1.50	2.80	0.92	0.68	0.28	.013
3.70	-1.33	2.67	0.91	0.67	0.30	.013
3.80	-1.17	2.55	0.90	0.67	0.32	.013
3.90	-1.03	2.44	0.90	0.67	0.35	.013
4.00	-0.88	2.35	0.90	0.67	0.37	.013
4.10	-0.76	2.29	0.91	0.67	0.39	.013
4.20	-0.65	2.23	0.91	0.68	0.41	.013
4.30	-0.56	2.18	0.92	0.68	0.43	.013
4.40	-0.48	2.13	0.92	0.68	0.45	.013
4.50	-0.42	2.09	0.93	0.68	0.46	.013
4.60	-0.36	2.03	0.92	0.68	0.48	.013
4.80	-0.25	1.93	0.92	0.68	0.51	.013
5.00	-0.16	1.83	0.92	0.68	0.54	.013

Holmium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\hat{\varepsilon}$)	R(ϕ=0)
0.10	-473.26	139.73	3.18	1.26	0.00	.111
0.12	-319.14	111.11	3.07	1.24	0.00	.103
0.14	-225.53	93.88	3.06	1.24	0.00	.103
0.16	-164.81	83.86	3.17	1.26	0.00	.110
0.18	-124.16	77.11	3.32	1.29	0.00	.120
0.20	-95.64	71.17	3.43	1.31	0.01	.128
0.22	-73.61	67.96	3.65	1.35	0.01	.142
0.24	-57.96	66.26	3.89	1.39	0.01	.158
0.26	-47.49	64.23	4.02	1.42	0.01	.168
0.28	-38.93	62.00	4.14	1.44	0.01	.175
0.30	-31.43	60.65	4.29	1.47	0.01	.186
0.32	-26.04	60.17	4.45	1.49	0.01	.196
0.34	-21.90	60.26	4.60	1.52	0.01	.205
0.36	-19.48	61.17	4.73	1.54	0.01	.214
0.38	-19.54	62.11	4.77	1.54	0.01	.217
0.40	-21.10	61.90	4.71	1.53	0.01	.212
0.42	-23.31	60.37	4.55	1.51	0.01	.202
0.44	-25.53	57.79	4.34	1.47	0.01	.189
0.46	-27.87	54.16	4.07	1.43	0.01	.170
0.48	-29.43	49.51	3.75	1.37	0.01	.149
0.50	-29.86	44.35	3.44	1.31	0.02	.128
0.52	-28.99	39.45	3.16	1.26	0.02	.109
0.54	-27.40	35.35	2.94	1.21	0.02	.095
0.56	-25.76	31.76	2.75	1.17	0.02	.083
0.58	-23.74	28.68	2.60	1.14	0.02	.073
0.60	-21.68	26.18	2.48	1.11	0.02	.066
0.62	-19.75	24.01	2.38	1.09	0.02	.060
0.64	-17.74	22.24	2.31	1.08	0.03	.056
0.66	-15.91	20.78	2.27	1.06	0.03	.054
0.68	-14.19	19.54	2.23	1.06	0.03	.052
0.70	-12.59	18.41	2.20	1.05	0.04	.050
0.72	-10.86	17.52	2.21	1.05	0.04	.051
0.74	-9.33	16.88	2.23	1.06	0.05	.052
0.76	-7.91	16.35	2.26	1.06	0.05	.054
0.78	-6.52	15.92	2.31	1.08	0.05	.056
0.80	-5.00	15.74	2.40	1.10	0.06	.061
0.82	-3.72	15.91	2.51	1.12	0.06	.068
0.84	-2.72	16.30	2.63	1.15	0.06	.075
0.86	-2.19	16.79	2.71	1.17	0.06	.080
0.88	-1.82	17.13	2.78	1.18	0.06	.084
0.90	-1.72	17.42	2.81	1.19	0.06	.086
0.92	-1.70	17.52	2.82	1.19	0.06	.087
0.94	-1.76	17.49	2.81	1.19	0.06	.087
0.96	-1.79	17.31	2.79	1.18	0.06	.085
0.98	-1.76	17.04	2.77	1.18	0.06	.084
1.00	-1.62	16.76	2.76	1.17	0.06	.083
1.05	-1.28	16.22	2.74	1.17	0.06	.082
1.10	-0.93	15.74	2.72	1.17	0.06	.081
1.15	-0.65	15.35	2.71	1.16	0.07	.080

Ho $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\hat{\varepsilon}$)	R(ϕ=0)
1.20	-0.38	14.96	2.70	1.16	0.07	.079
1.25	-0.07	14.85	2.70	1.16	0.07	.079
1.30	0.14	14.86	2.70	1.16	0.07	.080
1.35	0.34	14.90	2.71	1.16	0.07	.080
1.40	0.54	14.26	2.72	1.17	0.07	.081
1.45	0.54	14.38	2.73	1.17	0.07	.082
1.50	0.34	14.47	2.72	1.17	0.07	.081
1.55	0.10	14.46	2.70	1.16	0.07	.079
1.60	-0.27	14.45	2.66	1.15	0.07	.077
1.65	-0.72	14.29	2.61	1.14	0.07	.074
1.70	-1.06	14.04	2.55	1.13	0.07	.070
1.75	-1.53	13.81	2.49	1.12	0.07	.066
1.80	-1.98	13.43	2.41	1.10	0.07	.062
1.85	-2.43	12.94	2.32	1.08	0.07	.057
1.90	-2.70	12.31	2.23	1.05	0.08	.052
1.95	-2.76	11.72	2.15	1.04	0.08	.048
2.00	-2.78	11.25	2.10	1.02	0.08	.045
2.05	-2.73	10.85	2.06	1.01	0.09	.043
2.10	-2.71	10.55	2.02	1.01	0.09	.041
2.15	-2.73	10.31	1.99	1.00	0.09	.040
2.20	-2.82	10.07	1.95	0.99	0.09	.038
2.30	-3.01	9.55	1.87	0.97	0.10	.034
2.40	-3.27	9.00	1.78	0.94	0.10	.030
2.50	-3.47	8.36	1.67	0.91	0.10	.026
2.60	-3.62	7.68	1.56	0.88	0.11	.022
2.70	-3.64	7.00	1.46	0.85	0.11	.019
2.80	-3.59	6.38	1.37	0.83	0.12	.017
2.90	-3.49	5.81	1.28	0.80	0.13	.015
3.00	-3.35	5.29	1.21	0.78	0.13	.014
3.10	-3.20	4.82	1.14	0.75	0.14	.013
3.20	-3.02	4.37	1.07	0.73	0.15	.013
3.30	-2.80	3.98	1.02	0.71	0.17	.012
3.40	-2.58	3.65	0.97	0.70	0.18	.012
3.50	-2.35	3.36	0.94	0.69	0.20	.013
3.60	-2.13	3.12	0.91	0.67	0.22	.013
3.70	-1.91	2.92	0.89	0.67	0.24	.013
3.80	-1.72	2.76	0.88	0.66	0.26	.013
3.90	-1.54	2.62	0.87	0.66	0.28	.013
4.00	-1.38	2.49	0.86	0.65	0.31	.013
4.10	-1.23	2.37	0.85	0.65	0.33	.014
4.20	-1.06	2.29	0.86	0.65	0.36	.013
4.30	-0.96	2.22	0.85	0.65	0.38	.014
4.40	-0.84	2.16	0.86	0.66	0.40	.013
4.50	-0.76	2.10	0.86	0.66	0.42	.013
4.60	-0.69	2.03	0.85	0.65	0.44	.014
4.80	-0.52	1.90	0.85	0.65	0.49	.014
5.00	-0.40	1.79	0.85	0.65	0.53	.014

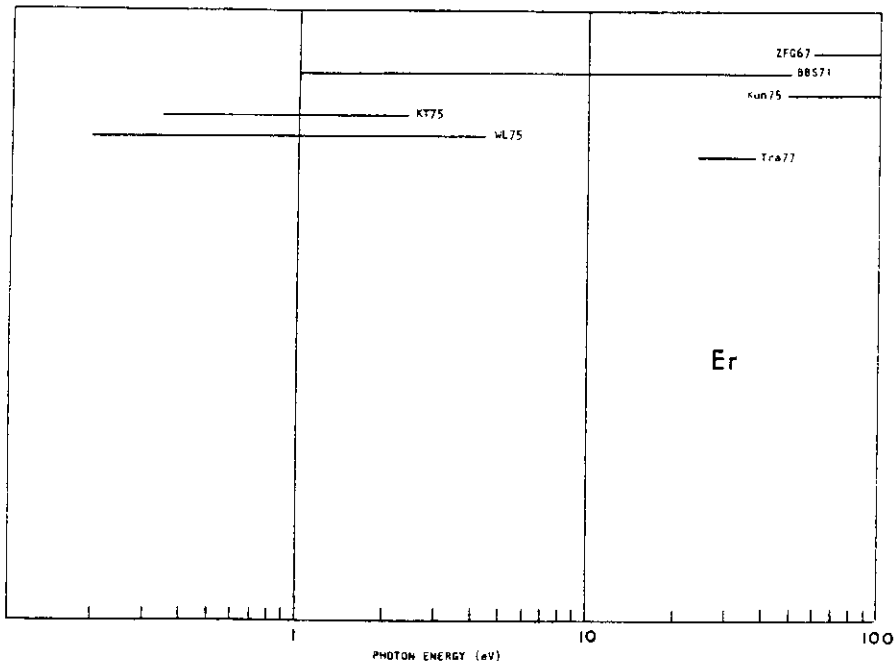

Fig. 75 Survey of available data on Er.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Er
FZG67	161-180	Trans		x				μ	absorption measurements
ZFG67	60-470	Trans		x				μ	absorption measurements
BBS71	1-50	Trans		x				$Im(\epsilon^{-1})$	energy loss spectroscopy
TC73	160-200	Trans		x				μ	energy loss spectroscopy
Kun75	50-550	Trans		x				μ	absorption measurements with synchrotron radiation
KT75	0.35-2.5	Ellips		x				σ	
WL75	0.2-4.4	Refl	4.2		x		EP	A; KK: σ for E⊥c and E∥c	absorptivity measured by calorimetry; examine optical anisotropy
CGT76		Trans		x					energy loss spectroscopy
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	24-38	Trans	vapor	x				μ	absorption measurements of metal vapor with synchrotron radiation
Lyn78									review paper

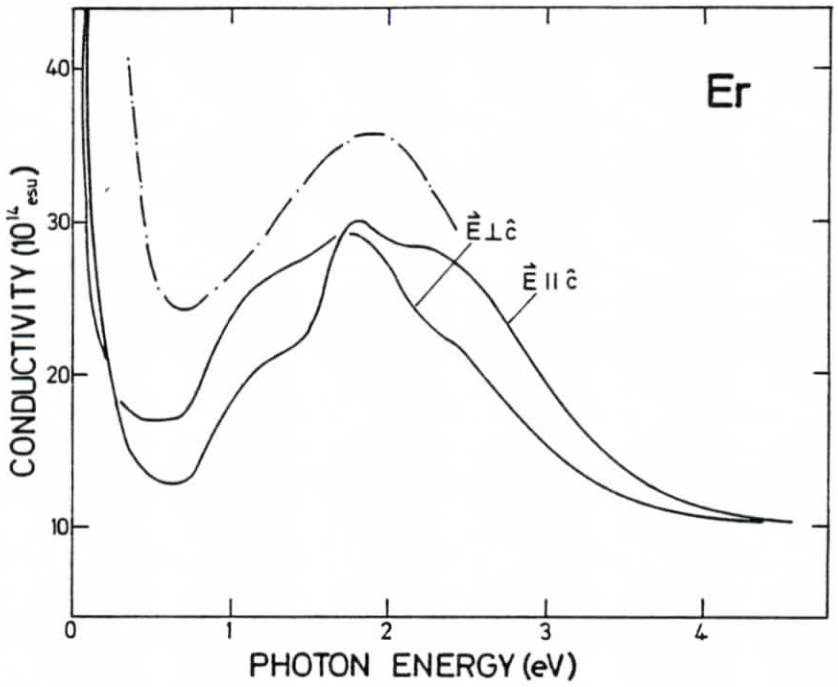

Fig. 77 Optical conductivity for Er. Single crystal results by WL75 (——) for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by KT75 (—·—).

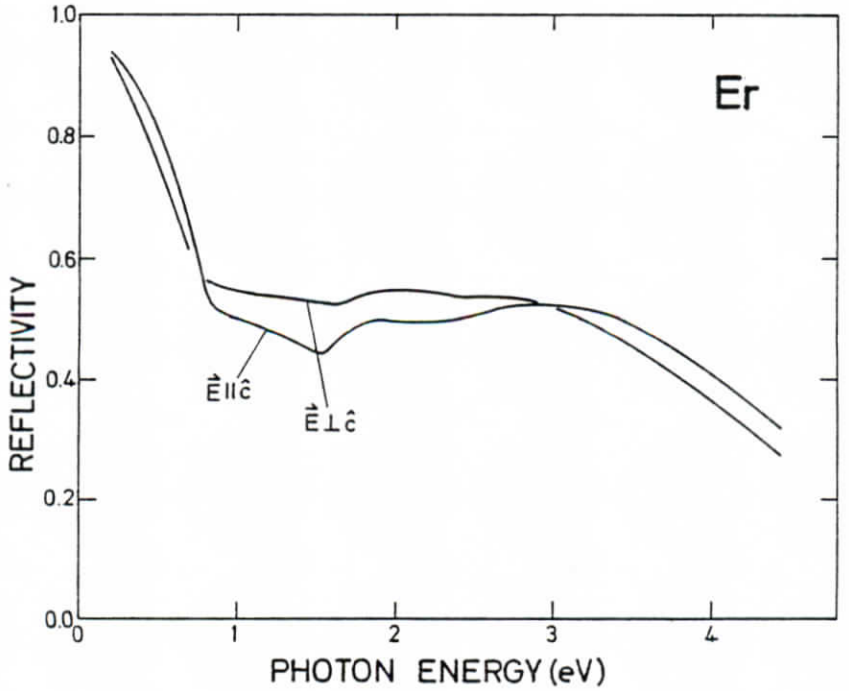

Fig. 76 Reflectivity for Er. Single crystal results by WL75 for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$.

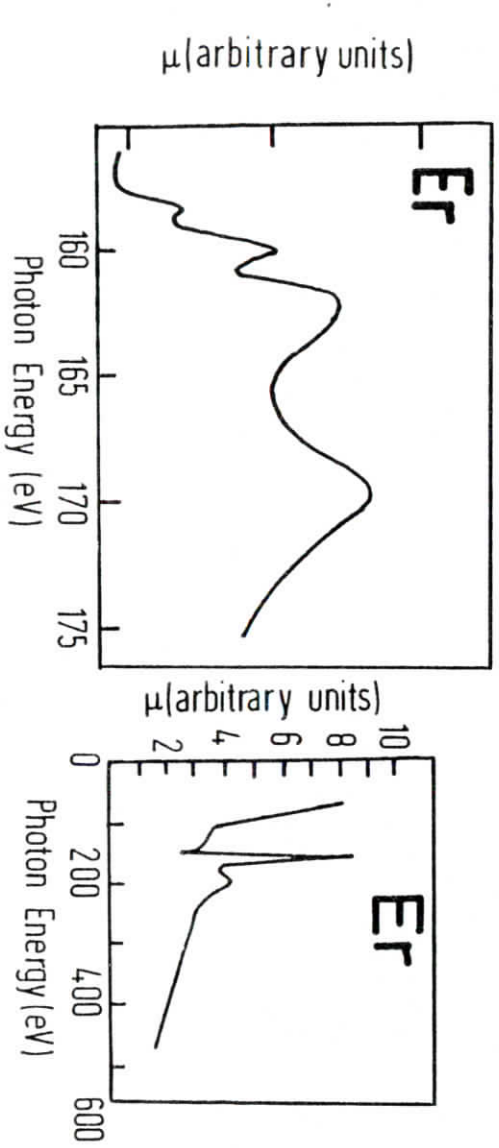

Fig. 78 Absorption coefficient of Er. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

Erbium single crystal with $\vec{E} \parallel \vec{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975) based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-596.04	249.34	5.00	1.58	0.00	.231
0.14	-306.76	142.33	3.96	1.41	0.00	.183
0.18	-185.78	102.56	3.64	1.35	0.00	.161
0.22	-126.85	78.51	3.34	1.29	0.00	.122
0.26	-92.05	61.24	3.04	1.23	0.01	.102
0.30	-68.29	50.40	2.88	1.20	0.01	.091
0.34	-52.33	42.08	2.72	1.17	0.01	.081
0.38	-39.84	36.90	2.69	1.16	0.01	.079
0.42	-31.09	33.55	2.71	1.16	0.02	.080
0.46	-25.14	30.55	2.69	1.16	0.02	.079
0.50	-20.07	28.29	2.70	1.16	0.02	.080
0.54	-16.61	26.40	2.70	1.16	0.03	.079
0.58	-13.91	24.39	2.66	1.15	0.03	.077
0.62	-11.13	22.62	2.65	1.15	0.04	.077
0.66	-8.75	21.27	2.67	1.16	0.04	.078
0.70	-6.52	20.25	2.72	1.17	0.04	.080
0.75	-4.00	19.60	2.83	1.19	0.05	.088
0.80	-2.40	19.56	2.94	1.21	0.05	.095
0.85	-1.39	19.63	3.02	1.23	0.05	.100
0.90	-0.93	19.69	3.06	1.24	0.05	.103
0.95	-0.72	19.57	3.07	1.24	0.05	.104
1.00	-0.66	19.38	3.06	1.24	0.05	.103
1.05	-0.76	19.13	3.03	1.23	0.05	.101
1.10	-0.94	18.79	2.99	1.22	0.05	.098
1.15	-1.16	18.37	2.94	1.21	0.05	.095
1.20	-1.34	17.87	2.88	1.20	0.06	.091
1.25	-1.50	17.40	2.83	1.19	0.06	.087
1.30	-1.65	16.93	2.77	1.18	0.06	.084
1.35	-1.80	16.47	2.72	1.17	0.06	.081
1.40	-1.92	16.02	2.67	1.15	0.06	.077
1.45	-2.03	15.59	2.62	1.14	0.06	.074
1.50	-2.12	15.21	2.57	1.13	0.06	.072
1.55	-2.23	14.90	2.53	1.13	0.07	.069
1.60	-2.37	14.64	2.50	1.12	0.07	.067
1.65	-2.60	14.42	2.45	1.11	0.07	.064
1.70	-2.97	14.14	2.40	1.09	0.07	.061
1.75	-3.30	13.76	2.33	1.08	0.07	.057
1.80	-3.66	13.35	2.26	1.06	0.07	.053
1.85	-3.96	12.86	2.18	1.04	0.07	.049
1.90	-4.28	12.34	2.10	1.02	0.07	.045
1.95	-4.49	11.74	2.01	1.00	0.07	.041
2.00	-4.66	11.14	1.93	0.98	0.08	.036
2.10	-4.72	10.01	1.78	0.94	0.08	.030
2.20	-4.64	9.02	1.66	0.91	0.09	.026
2.30	-4.45	8.23	1.57	0.88	0.09	.022
2.40	-4.33	7.57	1.48	0.86	0.10	.020
2.50	-4.24	6.95	1.40	0.84	0.10	.018
2.60	-4.16	6.32	1.30	0.81	0.11	.016
2.70	-4.01	5.70	1.22	0.78	0.12	.014

Er $\vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
2.90	-3.82	5.12	1.13	0.75	0.13	.013
2.90	-3.54	4.61	1.07	0.73	0.14	.013
3.00	-3.27	4.19	1.01	0.71	0.15	.012
3.10	-3.02	3.82	0.96	0.69	0.16	.012
3.20	-2.76	3.49	0.92	0.68	0.18	.013
3.30	-2.48	3.21	0.89	0.67	0.20	.013
3.40	-2.23	2.98	0.86	0.66	0.22	.013
3.50	-2.00	2.80	0.85	0.65	0.24	.014
3.60	-1.80	2.63	0.83	0.65	0.26	.014
3.70	-1.60	2.48	0.82	0.64	0.28	.014
3.80	-1.41	2.36	0.82	0.64	0.31	.014
3.90	-1.24	2.26	0.82	0.64	0.34	.014
4.00	-1.09	2.16	0.82	0.64	0.37	.014
4.10	-0.95	2.07	0.81	0.64	0.40	.014
4.20	-0.81	2.00	0.82	0.64	0.43	.014
4.30	-0.67	1.94	0.83	0.64	0.46	.014
4.40	-0.55	1.90	0.85	0.65	0.49	.014
4.50	-0.45	1.87	0.86	0.66	0.51	.013
4.60	-0.35	1.84	0.87	0.66	0.52	.013
4.80	-0.23	1.79	0.89	0.67	0.55	.013
5.00	-0.11	1.74	0.90	0.67	0.57	.013

Erbium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.08	-911.67	554.79	8.82	2.10	0.00	.423
0.10	-631.01	384.01	6.98	1.87	0.00	.342
0.14	-357.65	189.33	4.85	1.56	0.00	.221
0.18	-226.93	113.36	3.66	1.35	0.00	.143
0.22	-153.86	81.14	3.17	1.26	0.00	.110
0.26	-112.55	60.51	2.76	1.17	0.00	.083
0.30	-84.94	46.80	2.45	1.11	0.00	.064
0.34	-65.34	37.47	2.23	1.06	0.01	.052
0.38	-50.79	31.31	2.11	1.03	0.01	.045
0.42	-39.94	27.17	2.05	1.01	0.01	.042
0.46	-31.78	24.44	2.04	1.01	0.02	.042
0.50	-25.76	22.24	2.03	1.01	0.02	.042
0.54	-21.04	20.56	2.05	1.01	0.02	.042
0.58	-17.52	18.92	2.03	1.01	0.03	.042
0.62	-14.44	17.29	2.01	1.00	0.03	.041
0.66	-11.55	15.68	2.01	1.00	0.04	.041
0.70	-8.75	14.91	2.07	1.02	0.05	.043
0.75	-5.58	14.49	2.23	1.06	0.06	.052
0.80	-3.44	14.57	2.40	1.10	0.07	.061
0.85	-2.04	14.79	2.54	1.13	0.07	.069
0.90	-1.11	14.96	2.64	1.15	0.07	.075
0.95	-0.53	15.06	2.70	1.16	0.07	.079
1.00	-0.22	15.06	2.72	1.17	0.07	.081
1.05	-0.04	14.91	2.73	1.17	0.07	.081
1.10	0.05	14.67	2.71	1.16	0.07	.080
1.15	0.23	14.35	2.70	1.16	0.07	.079
1.20	0.31	14.10	2.68	1.16	0.07	.079
1.25	0.40	13.79	2.66	1.15	0.07	.077
1.30	0.47	13.47	2.64	1.15	0.07	.076
1.35	0.65	13.13	2.63	1.15	0.08	.075
1.40	0.84	12.88	2.62	1.14	0.08	.075
1.45	1.13	12.66	2.63	1.15	0.08	.075
1.50	1.48	12.62	2.66	1.15	0.08	.077
1.55	1.78	12.66	2.72	1.17	0.09	.080
1.60	1.73	13.37	2.76	1.17	0.07	.083
1.65	1.38	13.81	2.76	1.18	0.07	.083
1.70	0.69	14.09	2.72	1.17	0.07	.081
1.75	0.00	14.00	2.65	1.15	0.07	.076
1.80	-0.69	13.74	2.56	1.13	0.07	.071
1.85	-1.20	13.27	2.46	1.11	0.07	.065
1.90	-1.56	12.77	2.38	1.09	0.08	.060
1.95	-1.77	12.30	2.31	1.07	0.08	.056
2.00	-1.97	11.91	2.25	1.06	0.08	.053
2.10	-2.25	11.20	2.14	1.03	0.09	.047
2.20	-2.53	10.60	2.05	1.01	0.09	.042
2.30	-2.83	10.03	1.95	0.99	0.09	.038
2.40	-3.15	9.43	1.84	0.96	0.10	.033
2.50	-3.46	8.79	1.73	0.93	0.10	.028
2.60	-3.72	8.07	1.61	0.90	0.10	.024

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Tm
FZG67	167-186			x				μ	absorption measurements
ZFG67	60-520			x				μ	absorption measurements
BBS71	1-46			x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
Pet72	1.5-6.2	Trans, Refl		x				T,R,σ	
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
WL75	0.2-4.4		4.2		x		EP	A; KK: σ for E⊥c and E∥c	absorptivity measured by calorimetry; observed optical anisotropy
CGT76		Trans		x					energy loss spectroscopy
Kny77	0.06-4.9	Ellips	80, 293, 450			x		n,k,σ,$\varepsilon_{2\omega}$	
Liu77									review paper covering band structure, optical and photoemission properties
Tra77	24-36	Trans	vapor	x				μ	absorption measurements of metal vapor with synchrotron radiation
KN77									review paper
Lyn78									review paper

Er E⊥c

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(ψ=0)
2.70	-3.85	7.30	1.48	0.86	0.11	.020
2.80	-3.83	6.50	1.37	0.83	0.11	.017
2.90	-3.74	5.90	1.27	0.80	0.12	.015
3.00	-3.60	5.31	1.19	0.77	0.13	.014
3.10	-3.41	4.78	1.11	0.74	0.14	.013
3.20	-3.21	4.31	1.04	0.72	0.15	.012
3.30	-2.98	3.88	0.98	0.70	0.16	.012
3.40	-2.72	3.52	0.93	0.68	0.18	.013
3.50	-2.46	3.24	0.89	0.67	0.20	.013
3.60	-2.23	2.97	0.86	0.66	0.22	.013
3.70	-1.99	2.76	0.84	0.65	0.24	.014
3.80	-1.78	2.59	0.83	0.64	0.26	.014
3.90	-1.59	2.43	0.81	0.64	0.29	.014
4.00	-1.42	2.29	0.80	0.63	0.32	.015
4.10	-1.24	2.17	0.79	0.63	0.35	.015
4.20	-1.08	2.07	0.79	0.63	0.38	.015
4.30	-0.92	1.99	0.80	0.63	0.41	.015
4.40	-0.79	1.93	0.80	0.63	0.44	.014
4.50	-0.67	1.87	0.81	0.64	0.47	.014
4.60	-0.55	1.83	0.82	0.64	0.50	.014
4.66	-0.37	1.75	0.84	0.65	0.55	.014
5.00	-0.21	1.69	0.86	0.66	0.58	.013

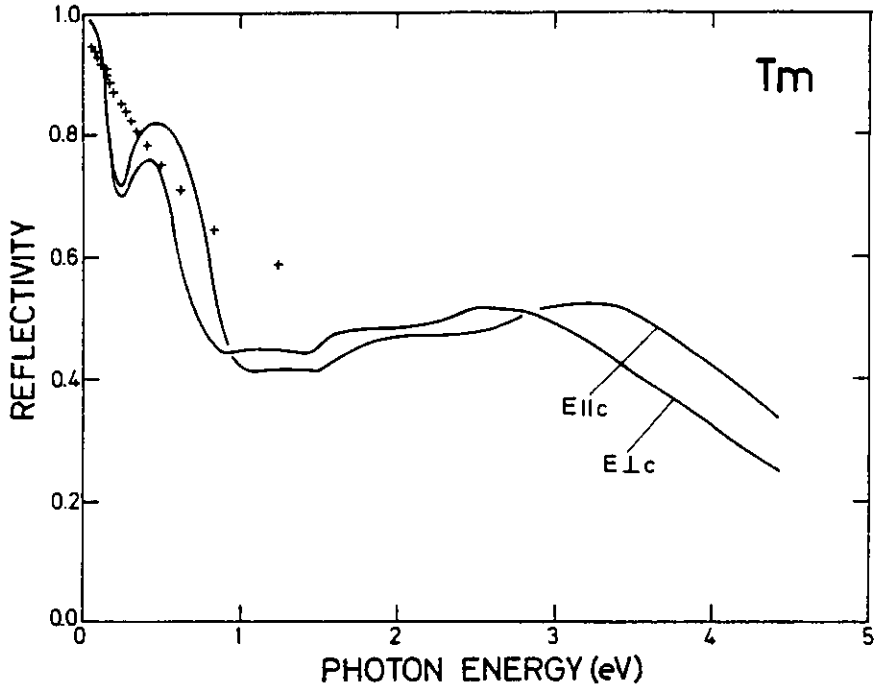

Fig. 80 Reflectivity for Tm. Single crystal results by WL75 (——) for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by Kny77 (+++).

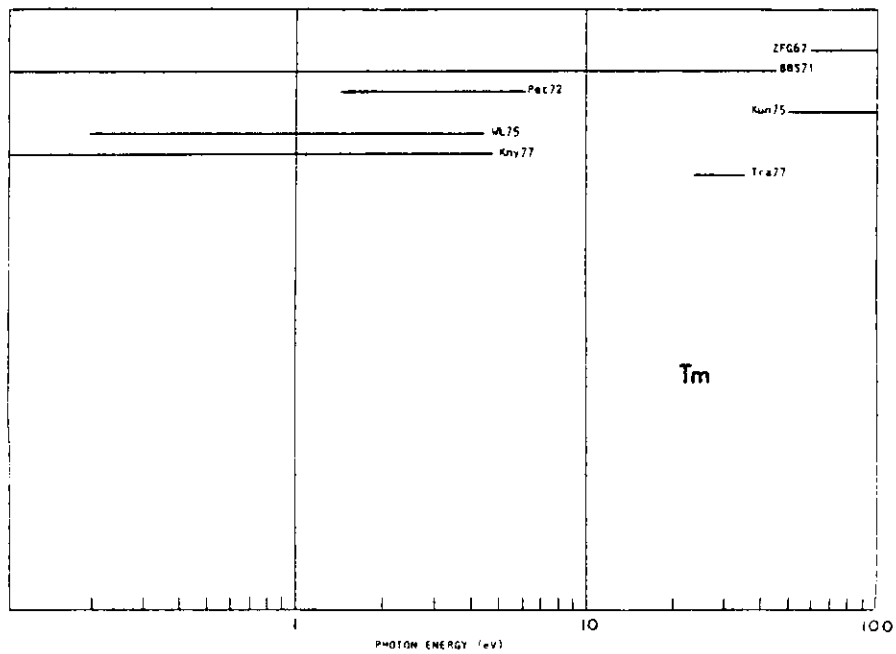

Fig. 79 Survey of available data on Tm.

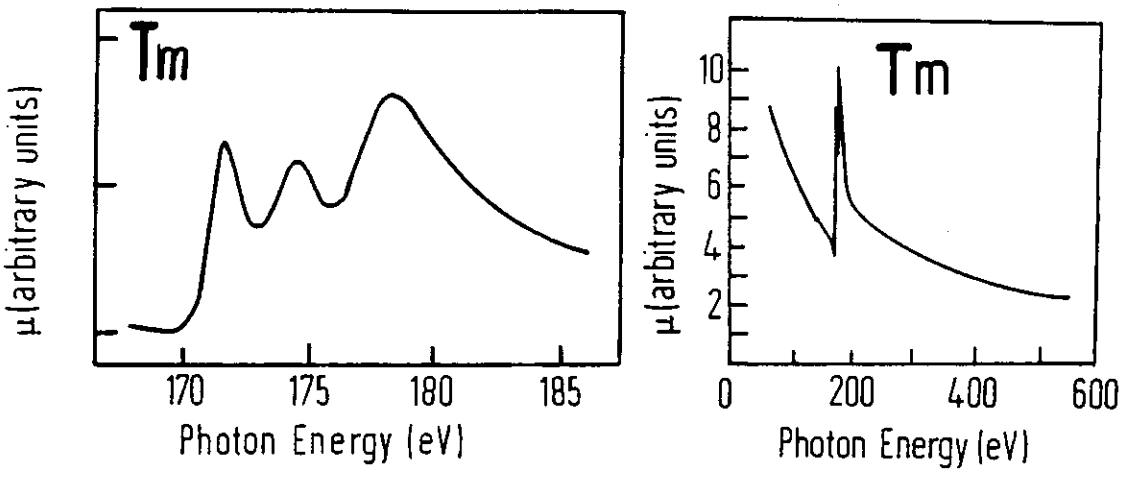

Fig. 82 Absorption coefficient of Tm. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

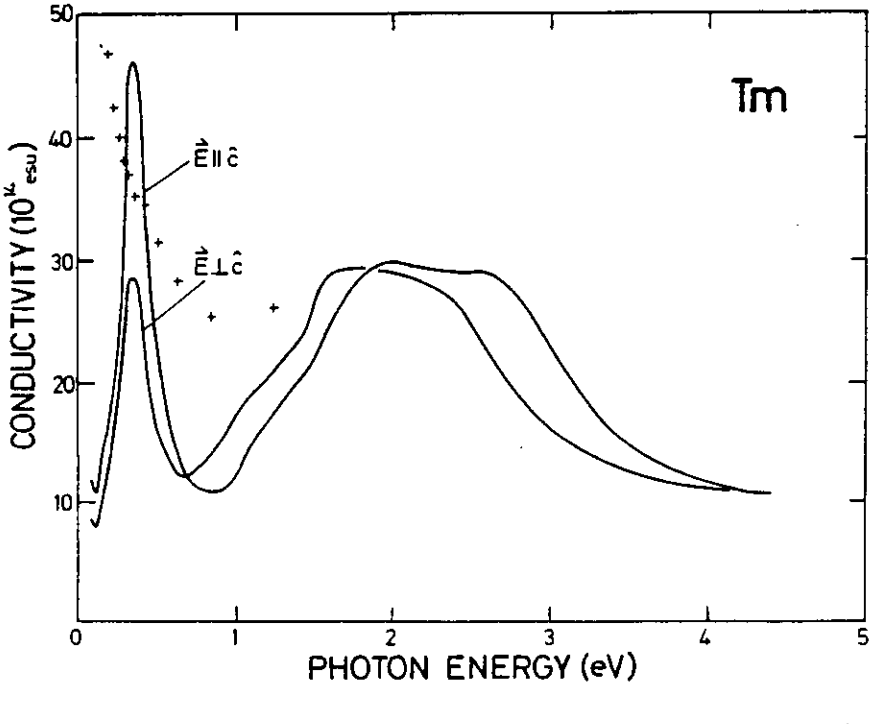

Fig. 81 Optical conductivity for Tm. Single crystal results by WL75 (——) for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by Kny77 (+++).

Thulium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\hat{\varepsilon}$)	R(ϕ=0)
0.10	-217.18	65.92	2.21	1.05	0.00	.051
0.12	-131.83	52.51	2.24	1.06	0.00	.053
0.14	-79.26	53.34	2.85	1.19	0.01	.069
0.16	-48.42	53.82	3.46	1.32	0.01	.130
0.18	-27.54	54.33	4.08	1.43	0.01	.172
0.20	-13.77	55.09	4.64	1.52	0.02	.209
0.21	-8.31	56.13	4.92	1.57	0.02	.226
0.22	-4.14	57.51	5.17	1.61	0.02	.242
0.23	-0.85	58.90	5.39	1.64	0.02	.255
0.24	1.47	60.32	5.56	1.67	0.02	.265
0.25	3.77	61.47	5.72	1.69	0.02	.274
0.26	5.52	63.38	5.88	1.71	0.02	.283
0.27	6.40	65.76	6.02	1.73	0.02	.291
0.28	6.34	68.50	6.13	1.75	0.01	.297
0.29	3.98	71.44	6.15	1.75	0.01	.298
0.30	1.11	72.33	6.06	1.74	0.01	.293
0.32	-4.77	72.23	5.81	1.71	0.01	.280
0.34	-10.79	69.80	5.47	1.65	0.01	.259
0.36	-15.92	65.44	5.07	1.59	0.01	.235
0.38	-19.84	60.01	4.66	1.53	0.02	.209
0.40	-22.60	53.92	4.23	1.46	0.02	.182
0.42	-23.84	47.64	3.84	1.38	0.02	.155
0.44	-23.87	41.85	3.49	1.32	0.02	.131
0.46	-23.40	36.50	3.16	1.26	0.02	.109
0.48	-22.23	31.43	2.85	1.19	0.02	.089
0.50	-20.26	26.63	2.57	1.13	0.02	.071
0.54	-14.43	21.26	2.38	1.09	0.03	.060
0.58	-10.30	18.36	2.32	1.08	0.04	.057
0.62	-7.11	16.30	2.31	1.07	0.05	.056
0.66	-3.98	15.04	2.41	1.10	0.06	.062
0.70	-1.87	14.51	2.53	1.12	0.07	.069
0.74	-0.24	14.13	2.64	1.15	0.07	.075
0.78	1.00	13.92	2.73	1.17	0.07	.082
0.82	2.00	13.79	2.82	1.19	0.07	.087
0.86	2.86	13.71	2.90	1.21	0.07	.093
0.90	3.59	13.81	2.99	1.22	0.07	.098
0.95	4.02	14.16	3.06	1.24	0.07	.103
1.00	4.18	14.30	3.09	1.24	0.06	.105
1.05	4.21	14.39	3.10	1.24	0.06	.105
1.10	4.13	14.42	3.09	1.24	0.06	.105
1.15	3.97	14.38	3.07	1.24	0.06	.104
1.20	3.82	14.24	3.05	1.23	0.07	.102
1.25	3.69	14.10	3.02	1.23	0.07	.100
1.30	3.59	13.95	3.00	1.22	0.07	.099
1.35	3.54	13.82	2.98	1.22	0.07	.098
1.40	3.64	13.73	2.99	1.22	0.07	.098
1.45	3.67	13.99	3.01	1.23	0.07	.100
1.50	3.43	14.43	3.02	1.23	0.07	.100
1.55	2.79	14.86	2.99	1.22	0.07	.098

Tm $\vec{E} \parallel \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\hat{\varepsilon}$)	R(ϕ=0)
1.60	1.85	14.92	2.91	1.21	0.07	.093
1.65	1.22	14.51	2.81	1.19	0.07	.086
1.70	0.64	14.24	2.73	1.17	0.07	.081
1.75	0.15	13.84	2.64	1.15	0.07	.076
1.80	-0.24	13.46	2.57	1.13	0.07	.072
1.85	-0.62	13.09	2.50	1.12	0.08	.067
1.90	-0.93	12.70	2.43	1.10	0.08	.063
1.95	-1.21	12.35	2.37	1.09	0.08	.059
2.00	-1.52	12.00	2.30	1.07	0.08	.056
2.10	-2.02	11.26	2.17	1.04	0.09	.049
2.20	-2.49	10.55	2.04	1.01	0.09	.042
2.30	-2.90	9.85	1.92	0.98	0.09	.036
2.40	-3.42	9.03	1.77	0.94	0.10	.030
2.50	-3.65	8.06	1.61	0.90	0.10	.024
2.60	-3.72	7.14	1.47	0.86	0.11	.020
2.70	-3.60	6.31	1.35	0.82	0.12	.017
2.80	-3.43	5.59	1.25	0.79	0.13	.015
2.90	-3.18	4.96	1.16	0.76	0.14	.013
3.00	-2.88	4.45	1.10	0.74	0.16	.013
3.10	-2.60	4.04	1.05	0.72	0.18	.012
3.20	-2.33	3.70	1.01	0.71	0.19	.012
3.30	-2.07	3.42	0.98	0.70	0.21	.012
3.40	-1.83	3.19	0.96	0.69	0.24	.012
3.50	-1.63	2.99	0.94	0.69	0.26	.013
3.60	-1.44	2.82	0.93	0.68	0.28	.013
3.70	-1.26	2.67	0.92	0.68	0.31	.013
3.80	-1.10	2.53	0.91	0.67	0.33	.013
3.90	-0.95	2.41	0.91	0.67	0.36	.013
4.00	-0.81	2.31	0.90	0.67	0.39	.013
4.10	-0.67	2.21	0.91	0.67	0.41	.013
4.20	-0.55	2.13	0.91	0.67	0.44	.013
4.30	-0.42	2.07	0.92	0.68	0.46	.013
4.40	-0.32	2.03	0.93	0.68	0.48	.013
4.50	-0.24	1.98	0.94	0.68	0.50	.013
4.60	-0.15	1.94	0.95	0.69	0.51	.013
4.80	-0.04	1.87	0.96	0.69	0.53	.012
5.00	0.05	1.80	0.96	0.69	0.56	.012

Thulium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/ϵ)	R(ϕ=0)
0.10	-267.58	91.29	2.75	1.17	0.00	.083
0.12	-161.49	72.76	2.80	1.18	0.00	.086
0.14	-95.35	75.39	3.62	1.35	0.01	.110
0.16	-59.30	75.16	4.27	1.46	0.01	.134
0.18	-35.80	73.11	4.78	1.55	0.01	.217
0.20	-16.99	71.58	5.32	1.63	0.01	.250
0.21	-10.02	71.93	5.59	1.67	0.01	.267
0.22	-3.33	72.03	5.86	1.71	0.01	.282
0.23	2.84	72.82	6.15	1.75	0.01	.298
0.24	8.87	74.22	6.47	1.80	0.01	.315
0.25	14.86	76.88	6.83	1.85	0.01	.334
0.26	19.64	81.78	7.21	1.90	0.01	.353
0.27	22.70	86.50	7.55	1.94	0.01	.369
0.28	23.24	95.83	7.81	1.98	0.01	.380
0.29	20.74	103.69	7.95	1.99	0.01	.387
0.30	15.31	110.23	7.96	1.99	0.01	.387
0.32	-1.66	116.85	7.58	1.95	0.01	.370
0.34	-17.43	112.33	6.94	1.66	0.01	.339
0.36	-28.91	104.36	6.30	1.77	0.01	.306
0.38	-39.02	93.90	5.60	1.67	0.01	.267
0.40	-43.45	81.96	4.97	1.58	0.01	.229
0.42	-46.32	70.62	4.37	1.48	0.01	.190
0.44	-45.72	60.37	3.87	1.39	0.01	.157
0.46	-44.32	51.56	3.44	1.31	0.01	.128
0.48	-41.57	44.34	3.10	1.24	0.01	.105
0.50	-38.81	38.25	2.80	1.18	0.01	.086
0.54	-32.64	29.45	2.38	1.09	0.02	.060
0.58	-27.14	23.41	2.09	1.02	0.02	.044
0.62	-22.28	19.12	1.88	0.97	0.02	.034
0.66	-18.00	16.26	1.77	0.94	0.03	.030
0.70	-14.57	13.93	1.67	0.91	0.03	.026
0.74	-11.22	12.44	1.66	0.91	0.04	.026
0.78	-8.45	11.64	1.72	0.93	0.06	.028
0.82	-6.51	10.85	1.75	0.94	0.07	.029
0.86	-4.32	10.32	1.85	0.96	0.08	.033
0.90	-2.59	10.13	1.98	1.00	0.09	.039
0.95	-0.80	10.06	2.16	1.04	0.10	.048
1.00	0.68	10.23	2.34	1.08	0.10	.058
1.05	1.72	10.69	2.50	1.12	0.09	.068
1.10	2.28	11.19	2.62	1.14	0.09	.074
1.15	2.63	11.45	2.68	1.16	0.08	.078
1.20	2.86	11.64	2.72	1.17	0.08	.081
1.25	3.02	11.76	2.76	1.17	0.08	.083
1.30	3.10	11.88	2.77	1.18	0.08	.084
1.35	3.14	11.93	2.78	1.18	0.08	.085
1.40	3.18	11.92	2.79	1.18	0.08	.085
1.45	3.33	11.88	2.80	1.18	0.08	.086
1.50	3.61	12.01	2.84	1.19	0.08	.089
1.55	3.62	12.53	2.89	1.20	0.07	.091

Tm $\vec{E} \perp \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/ϵ)	R(ϕ=0)
1.60	3.37	12.94	2.69	1.20	0.07	.092
1.65	2.92	13.27	2.87	1.20	0.07	.090
1.70	2.36	13.39	2.82	1.19	0.07	.087
1.75	1.77	13.31	2.76	1.17	0.07	.083
1.80	1.64	13.07	2.72	1.17	0.08	.081
1.85	1.01	13.34	2.68	1.16	0.07	.078
1.90	0.37	13.05	2.59	1.14	0.08	.073
1.95	-0.04	12.66	2.51	1.12	0.08	.068
2.00	-0.36	12.31	2.44	1.11	0.08	.064
2.10	-0.86	11.66	2.33	1.08	0.09	.057
2.20	-1.28	11.08	2.22	1.05	0.09	.051
2.30	-1.63	10.52	2.10	1.02	0.09	.045
2.40	-1.89	10.02	2.04	1.01	0.10	.042
2.50	-2.14	9.62	1.96	0.99	0.10	.038
2.60	-2.63	9.21	1.86	0.97	0.10	.034
2.70	-3.11	8.65	1.74	0.93	0.10	.029
2.80	-3.48	7.94	1.61	0.90	0.11	.024
2.90	-3.73	7.16	1.47	0.86	0.11	.020
3.00	-3.80	6.38	1.35	0.82	0.12	.016
3.10	-3.75	5.65	1.23	0.78	0.12	.014
3.20	-3.62	4.99	1.13	0.75	0.13	.013
3.30	-3.41	4.40	1.04	0.72	0.14	.012
3.40	-3.14	3.87	0.96	0.69	0.16	.012
3.50	-2.80	3.48	0.91	0.68	0.17	.013
3.60	-2.51	3.19	0.88	0.66	0.19	.013
3.70	-2.25	2.96	0.86	0.65	0.21	.013
3.80	-2.02	2.75	0.83	0.65	0.24	.014
3.90	-1.80	2.58	0.82	0.64	0.26	.014
4.00	-1.61	2.44	0.81	0.64	0.29	.014
4.10	-1.44	2.31	0.80	0.63	0.31	.015
4.20	-1.27	2.19	0.79	0.63	0.34	.015
4.30	-1.10	2.10	0.80	0.63	0.37	.015
4.40	-0.95	2.04	0.81	0.63	0.40	.014
4.50	-0.84	1.99	0.81	0.64	0.43	.014
4.60	-0.74	1.93	0.81	0.64	0.45	.014
4.80	-0.57	1.81	0.81	0.64	0.50	.014
5.00	-0.40	1.71	0.82	0.64	0.55	.014

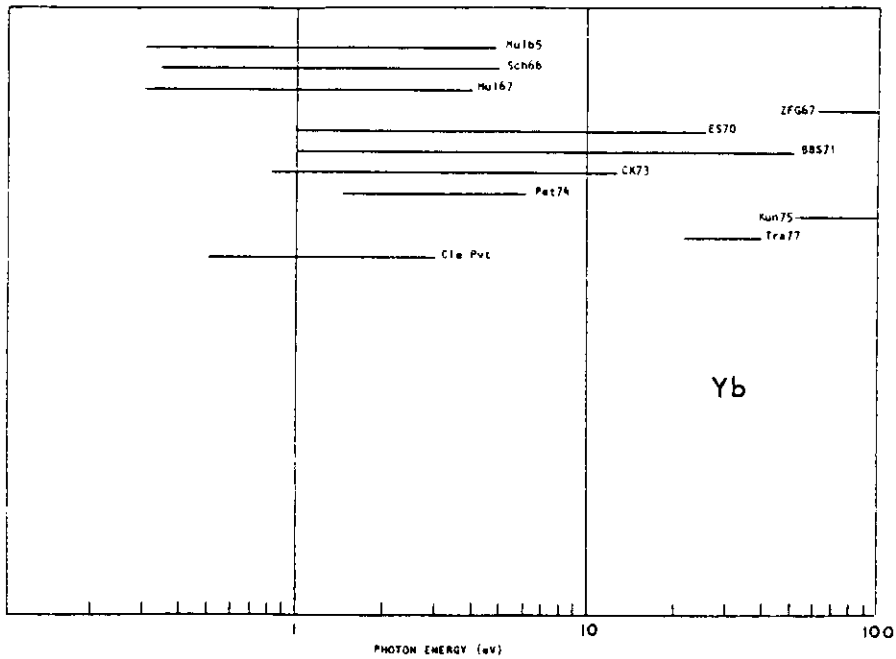

Fig. 83 Survey of available data on Yb.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Yb
Mul65	0.3-5	Refl		x				R	reflectance measured through window using existing n for sapphire
Sch66	0.35-5	Trans, Refl		x				R	
GZF67	167-187	Trans		x				μ	absorption measurements
Mul67	0.3-4.0	Trans, Refl		x				R; KK: $\varepsilon_1,\varepsilon_2,\sigma$	
ZFG67	60-520	Trans		x				μ	absorption measurements
ES70	1.0-11.6	Refl		x			In	R; KK: $\varepsilon_1,\varepsilon_2,\sigma,\mu$	
BBS71	1-50	Trans		x				$Im(\varepsilon^{-1})$	energy loss spectroscopy
CK73	0.83-10.33	Trans		x				μ	absorption measurements
TC73	175-196	Trans		x				μ	energy loss spectroscopy
Pet74	1.55-6.2	Trans, Refl		x				T,R,σ	
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
CGT76		Trans		x					energy loss spectroscopy
KN77									review paper
Liu77									review paper energy band structure, optical and photoemission properties
Tra77	22-39	Trans	vapor						absorption measurements of atomic vapor with synchrotron radiation
Cle Pvt	0.5-3	Trans, Refl		x				R,σ	

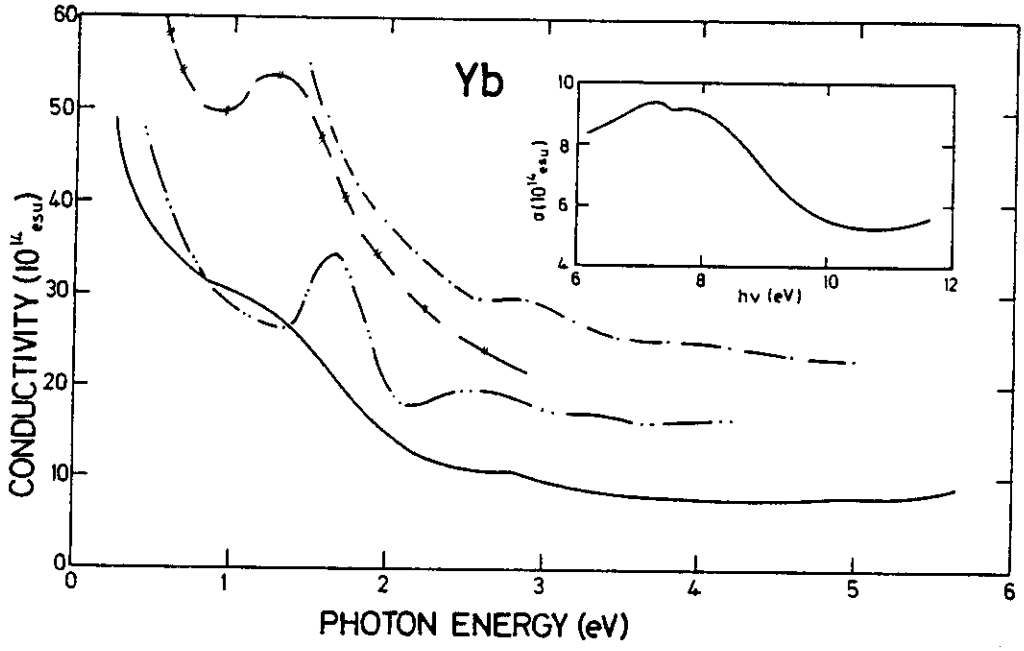

Fig. 85 Optical conductivity for Yb. Polycrystalline results by ES70 (——); Cleyet (pvt. comm. with Pet74 (—‖—); Pet74 (—·—); and Mul67 (— ··—).

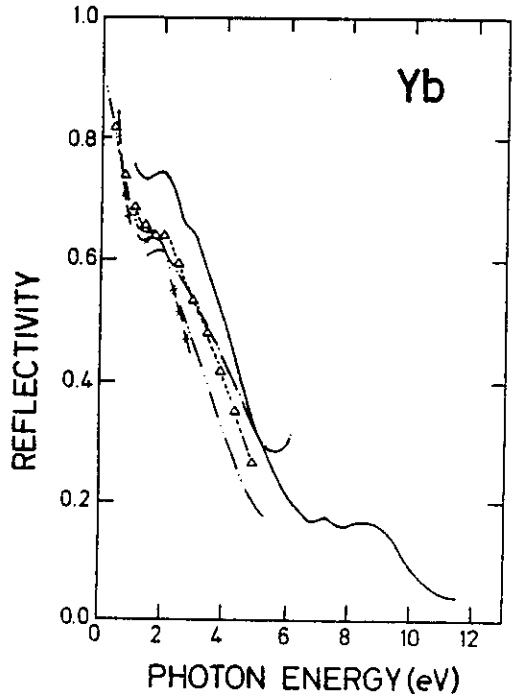

Fig. 84 Reflectivity for Yb. Polycrystalline results by ES70 (——); Cleyet (pvt. comm. with Pet74) (—‖—); Pet74 (—·—); Mul67 (— ··—); and Sch66 (ΔΔΔ).

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Lu
Sch66	0.3-5.5	Refl		x				R	
ZFG67	60-470			x				μ	absorption measurements
Kun75	50-550			x				μ	absorption measurements with synchrotron radiation
WL75	0.2-4.4	Refl	4.2		x		EP	A; KK: σ for E⊥c and E∥c	absorptivity measured by calorimetry; discuss anisotropy
CGT76		Trans		x					energy loss spectroscopy
Pet76	1.6-6.2	Trans, Refl		x				σ	
KN77									review paper
Liu77									review paper covering band structure, optical and photoemission properties
Lyn78				x					review paper
OTM80	0-60				x			$Im(\varepsilon^{-1})$	energy loss spectroscopy

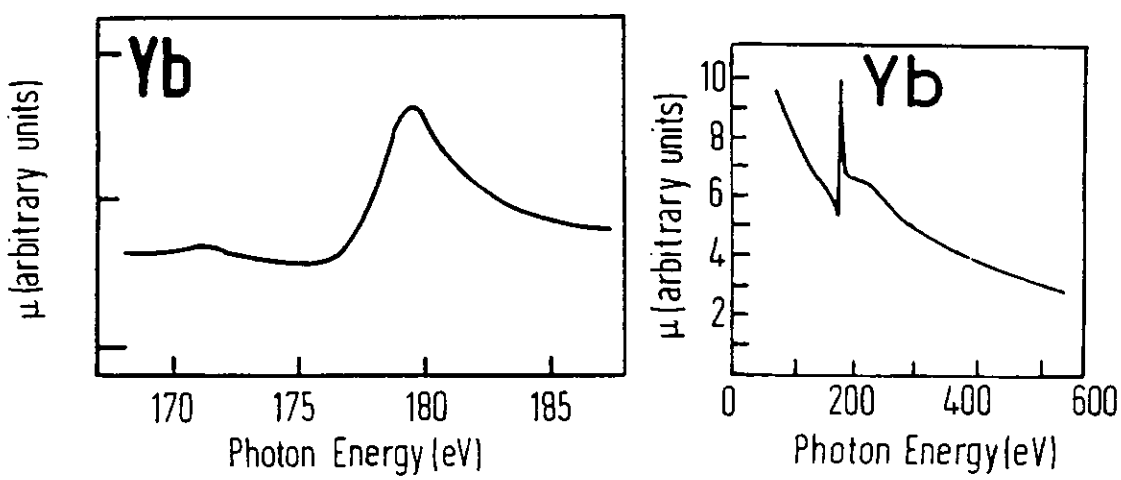

Fig. 86 Absorption coefficient of Yb. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

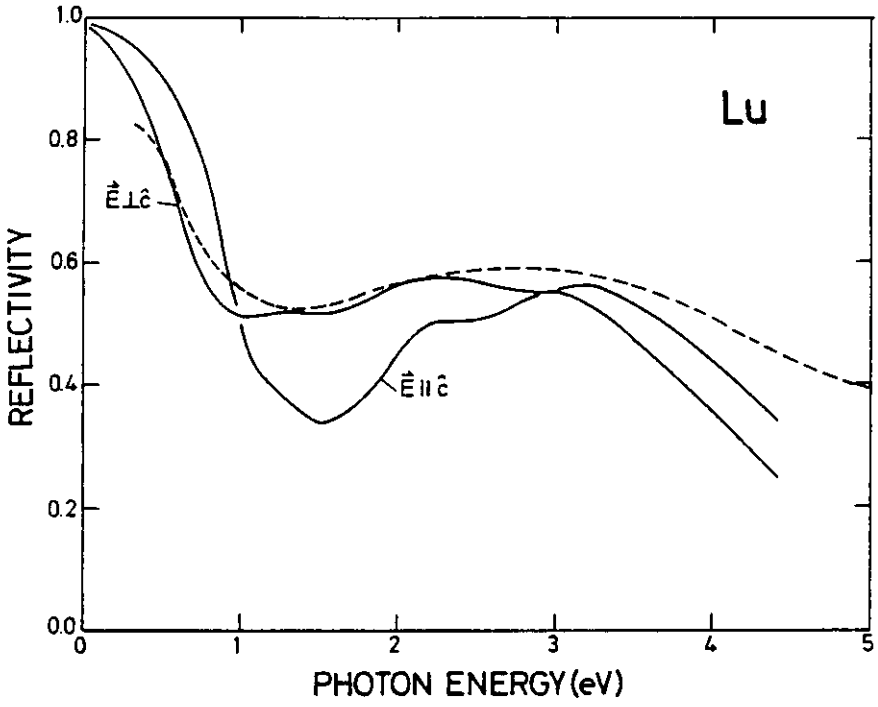

Fig. 88 Reflectivity for Lu. Single crystal results by WL75 (——) for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$; polycrystalline results by Sch66 (---).

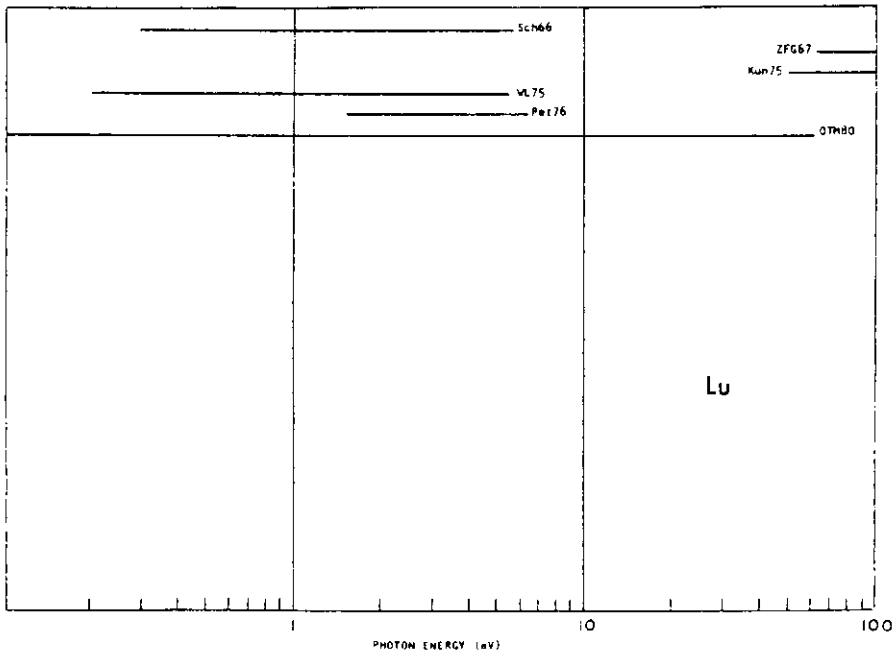

Fig. 87 Survey of available data on Lu.

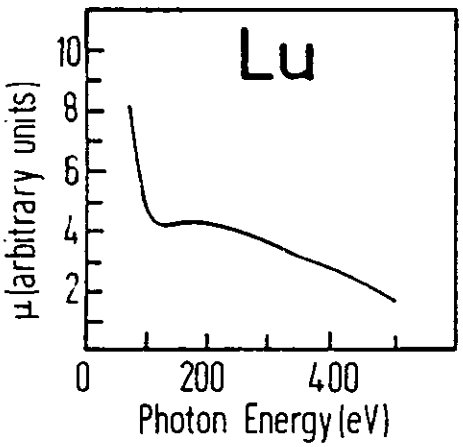

Fig. 90 Absorption coefficient of Lu. FZG67 show fine structure below the onset of the large maxima. Fine structure is interpolated by ZFG67 in the expanded energy range.

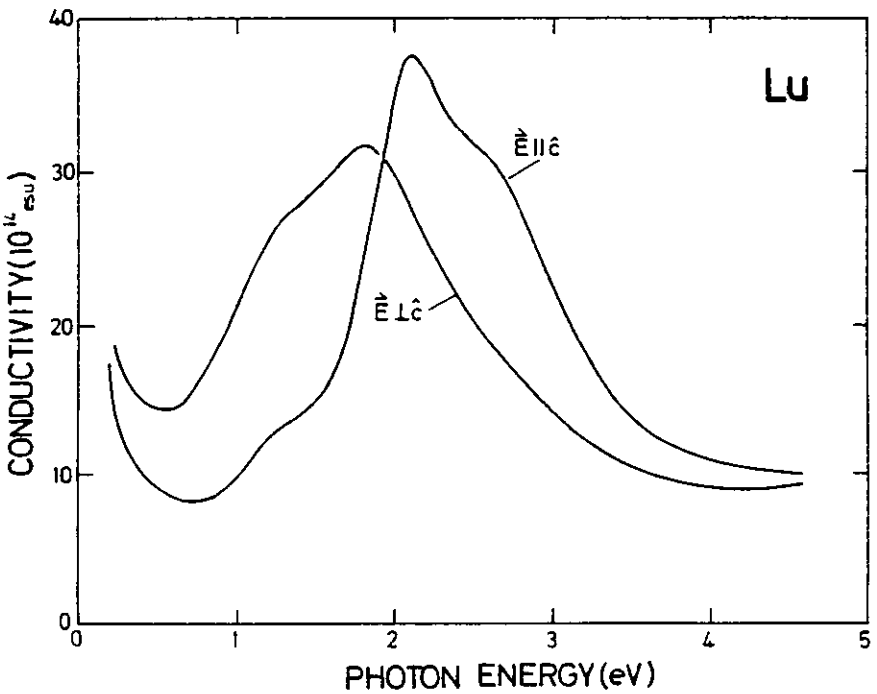

Fig. 89 Optical conductivity for Lu. Single crystal results by WL75 for $\vec{E} \parallel \hat{c}$ and $\vec{E} \perp \hat{c}$.

Lutetium single crystal with $\vec{E} \parallel \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
0.08	1546.75	616.83	40.10	4.48	0.00	.821
0.10	1942.02	350.70	32.72	4.04	0.00	.786
0.15	-487.04	139.55	3.13	1.25	0.00	.107
0.20	-277.88	69.62	2.07	1.02	0.00	.043
0.25	-175.78	45.42	1.70	0.92	0.00	.027
0.30	-120.17	32.44	1.47	0.86	0.00	.020
0.35	-86.27	26.20	1.39	0.84	0.00	.018
0.40	-64.72	21.91	1.34	0.82	0.00	.016
0.45	-50.13	19.31	1.34	0.82	0.01	.016
0.50	-40.01	16.58	1.28	0.80	0.01	.015
0.55	-32.18	14.60	1.26	0.79	0.01	.015
0.60	-26.25	12.88	1.22	0.78	0.02	.014
0.65	-21.48	11.34	1.19	0.77	0.02	.014
0.70	-17.45	10.06	1.16	0.76	0.02	.013
0.75	-13.98	9.02	1.15	0.76	0.03	.013
0.80	-10.88	8.44	1.20	0.78	0.04	.014
0.85	-8.32	8.21	1.30	0.81	0.06	.015
0.90	-6.31	8.05	1.40	0.84	0.08	.019
0.95	-4.54	8.00	1.53	0.87	0.09	.021
1.00	-3.10	8.04	1.66	0.91	0.11	.026
1.05	-1.85	8.18	1.81	0.95	0.12	.031
1.10	-1.04	8.41	1.93	0.98	0.12	.037
1.15	-0.41	8.50	2.01	1.00	0.12	.041
1.20	0.07	8.51	2.07	1.02	0.12	.043
1.25	0.59	8.42	2.12	1.03	0.12	.046
1.30	1.04	8.36	2.18	1.04	0.12	.049
1.35	1.50	8.25	2.22	1.05	0.12	.051
1.40	1.99	8.16	2.28	1.07	0.12	.054
1.45	2.47	8.12	2.34	1.08	0.11	.058
1.50	3.09	8.03	2.42	1.10	0.11	.062
1.55	3.74	8.23	2.53	1.12	0.10	.069
1.60	4.30	8.61	2.64	1.15	0.09	.076
1.65	4.75	9.09	2.74	1.17	0.09	.082
1.70	5.11	9.67	2.83	1.19	0.08	.088
1.75	5.34	10.36	2.92	1.21	0.08	.093
1.80	5.43	11.14	2.99	1.22	0.07	.098
1.85	5.25	12.08	3.03	1.23	0.07	.101
1.90	4.94	12.86	3.06	1.24	0.07	.103
1.95	4.24	13.91	3.06	1.24	0.07	.103
2.00	3.11	14.57	3.00	1.22	0.07	.099
2.10	0.57	14.79	2.77	1.16	0.07	.084
2.20	-1.36	13.69	2.49	1.12	0.07	.067
2.30	-2.27	12.32	2.26	1.06	0.08	.054
2.40	-2.70	11.29	2.11	1.03	0.08	.045
2.50	-3.08	10.55	1.99	1.00	0.09	.040
2.60	-3.59	9.84	1.86	0.96	0.09	.033
2.70	-4.05	9.00	1.71	0.92	0.09	.027
2.80	-4.38	8.06	1.55	0.88	0.10	.022
2.90	-4.47	7.14	1.41	0.84	0.10	.018

Lu $\vec{E} \parallel \hat{c}$

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
3.00	-4.50	6.26	1.27	0.80	0.11	.015
3.10	-4.39	5.38	1.13	0.75	0.11	.013
3.20	-4.08	4.61	1.02	0.71	0.12	.012
3.30	-3.69	4.04	0.94	0.69	0.13	.013
3.40	-3.34	3.59	0.88	0.66	0.15	.013
3.50	-2.99	3.22	0.84	0.65	0.17	.014
3.60	-2.65	2.92	0.80	0.63	0.19	.014
3.70	-2.34	2.71	0.79	0.63	0.21	.015
3.80	-2.09	2.52	0.77	0.62	0.24	.015
3.90	-1.84	2.36	0.76	0.62	0.26	.016
4.00	-1.62	2.23	0.75	0.61	0.29	.016
4.10	-1.42	2.13	0.75	0.61	0.33	.016
4.20	-1.24	2.04	0.76	0.62	0.36	.016
4.30	-1.07	1.98	0.77	0.62	0.39	.016
4.40	-0.97	1.87	0.75	0.61	0.42	.016
4.50	-0.78	1.81	0.77	0.62	0.47	.015
4.60	-0.66	1.78	0.79	0.63	0.49	.015
4.80	-0.47	1.71	0.81	0.64	0.54	.014
5.00	-0.32	1.64	0.82	0.64	0.59	.014

Lutetium single crystal with $\vec{E} \perp \hat{c}$

publication by J.H. Weaver and D.W. Lynch in Phys. Rev. Lett. 34, 1324 (1975)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-638.58	329.01	6.32	1.78	0.00	.307
0.15	-308.91	146.09	4.05	1.42	0.00	.169
0.20	-176.17	85.79	3.14	1.25	0.00	.108
0.25	-111.65	51.46	2.61	1.18	0.00	.086
0.30	-77.39	45.82	2.50	1.12	0.01	.068
0.35	-54.83	36.72	2.36	1.09	0.01	.059
0.40	-40.01	31.11	2.31	1.07	0.01	.056
0.45	-29.93	26.92	2.27	1.07	0.02	.054
0.50	-22.25	24.31	2.31	1.08	0.02	.056
0.55	-17.04	22.32	2.35	1.08	0.03	.058
0.60	-13.23	20.27	2.34	1.08	0.03	.058
0.65	-9.44	18.72	2.40	1.10	0.04	.061
0.70	-6.17	17.99	2.53	1.13	0.05	.069
0.75	-4.01	17.76	2.66	1.15	0.05	.077
0.80	-2.35	17.62	2.78	1.18	0.06	.084
0.85	-1.26	17.61	2.86	1.20	0.06	.090
0.90	-0.42	17.54	2.93	1.21	0.06	.094
0.95	0.13	17.53	2.97	1.22	0.06	.097
1.00	0.61	17.50	3.01	1.23	0.06	.099
1.05	0.83	17.61	3.04	1.23	0.06	.101
1.10	0.80	17.69	3.04	1.23	0.06	.101
1.15	0.66	17.66	3.03	1.23	0.06	.101
1.20	0.38	17.58	3.00	1.22	0.06	.099
1.25	0.08	17.37	2.95	1.22	0.06	.096
1.30	-0.25	17.09	2.90	1.20	0.06	.092
1.35	-0.51	16.72	2.85	1.19	0.06	.089
1.40	-0.71	16.37	2.80	1.18	0.06	.086
1.45	-0.87	16.05	2.76	1.17	0.06	.083
1.50	-1.00	15.82	2.72	1.17	0.06	.081
1.55	-1.26	15.67	2.69	1.16	0.06	.079
1.60	-1.53	15.50	2.65	1.15	0.06	.076
1.65	-1.90	15.36	2.61	1.14	0.06	.074
1.70	-2.35	15.15	2.55	1.13	0.06	.070
1.75	-2.82	14.88	2.48	1.11	0.06	.066
1.80	-3.32	14.57	2.41	1.10	0.07	.062
1.85	-3.91	14.15	2.32	1.08	0.07	.057
1.90	-4.43	13.58	2.22	1.05	0.07	.051
1.95	-4.82	12.93	2.12	1.03	0.07	.046
2.00	-5.16	12.27	2.02	1.00	0.07	.041
2.10	-5.61	10.85	1.82	0.95	0.07	.032
2.20	-5.65	9.50	1.64	0.91	0.08	.025
2.30	-5.48	8.36	1.50	0.87	0.08	.021
2.40	-5.22	7.43	1.39	0.83	0.09	.019
2.50	-4.97	6.63	1.29	0.80	0.10	.015
2.60	-4.68	5.91	1.20	0.77	0.10	.014
2.70	-4.36	5.33	1.12	0.75	0.11	.013
2.80	-4.08	4.82	1.06	0.73	0.12	.013
2.90	-3.82	4.35	0.99	0.70	0.13	.012
3.00	-3.58	3.89	0.92	0.68	0.14	.013

Lu $\vec{E} \perp \hat{c}$

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
3.10	-3.27	3.47	0.87	0.66	0.15	.013
3.20	-2.95	3.13	0.82	0.64	0.17	.014
3.30	-2.65	2.86	0.79	0.63	0.19	.015
3.40	-2.37	2.62	0.76	0.62	0.21	.016
3.50	-2.09	2.42	0.74	0.61	0.24	.016
3.60	-1.84	2.26	0.73	0.61	0.27	.017
3.70	-1.60	2.15	0.73	0.61	0.30	.017
3.80	-1.40	2.04	0.73	0.61	0.33	.017
3.90	-1.20	1.95	0.74	0.61	0.37	.017
4.00	-1.03	1.87	0.74	0.61	0.41	.016
4.10	-0.87	1.80	0.75	0.61	0.45	.016
4.20	-0.72	1.75	0.77	0.62	0.49	.016
4.30	-0.57	1.70	0.78	0.63	0.53	.015
4.40	-0.43	1.68	0.81	0.64	0.56	.014
4.50	-0.31	1.67	0.83	0.65	0.58	.014
4.60	-0.23	1.67	0.85	0.65	0.59	.014
4.80	-0.10	1.64	0.88	0.66	0.61	.013
5.00	0.00	1.60	0.89	0.67	0.62	.013

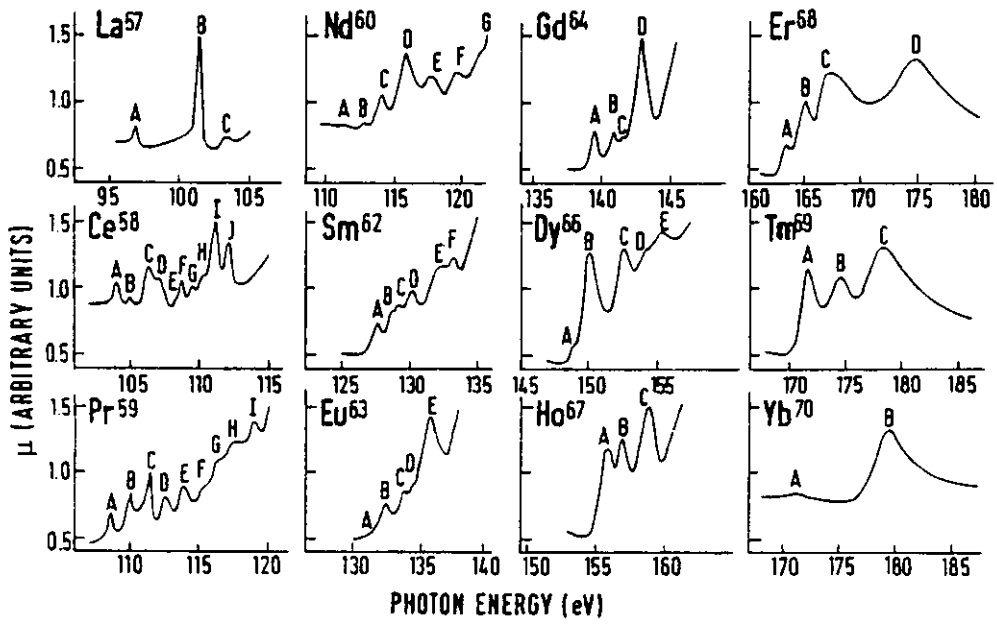

Fig. 91 Summary of the optical absorption coefficients for the rare earths, showing fine structure below the onset of the large maxima. Reported by FZG67.

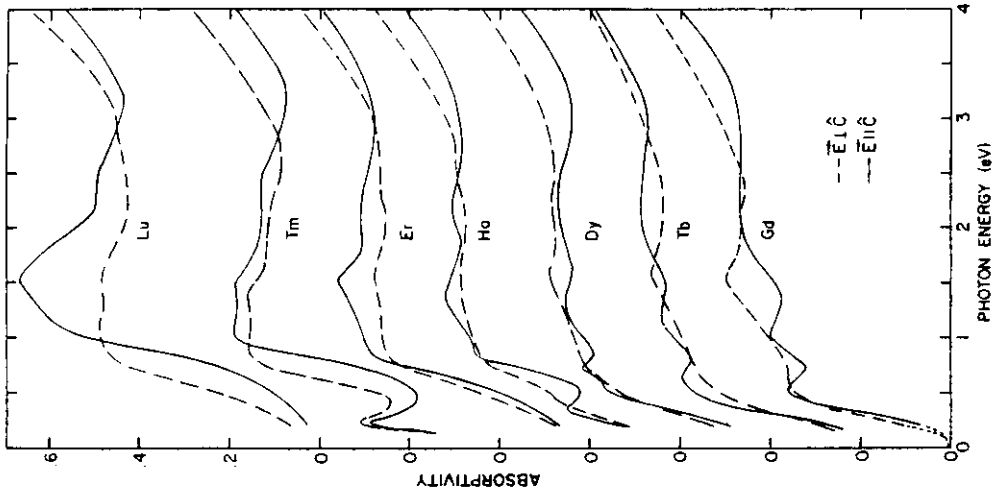

Fig. 92 Summary of the optical absorptivity (A = 1-R where R is the reflectivity) for the heavy rare earths reported by WL75 for single crystals at 4.2 K.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		Th
VKF73	0.5-6	Refl				x	EP, Sput	R; KK: σ	surface roughness resulting in plasmon-related artifact
We0177	0.2-8	Refl	4.2, 300			x	EP,Ex	R; KK: σ	absorptivity measured calorimetry for $h\nu < 4.4$ eV, reflectivity measured with synchrotron radiation for $2.5 < h\nu < 30$ eV
W0177	80-150	Trans		x				μ	optical absorption measurements, synchrotron radiation
CDG78	64-130	Trans		x				μ (absorption measurements); KK: μ (energy loss spectroscopy), $\mathrm{Im}(\varepsilon^{-1})$	optical absorption measurements with synchrotron radiation; fast energy loss spectroscopy with KK analysis
AN79	2-5	Refl		x	x			R; KK: σ	sample preparations varied
CGW80	2-160	Trans		x				μ	fast electron energy loss spectroscopy

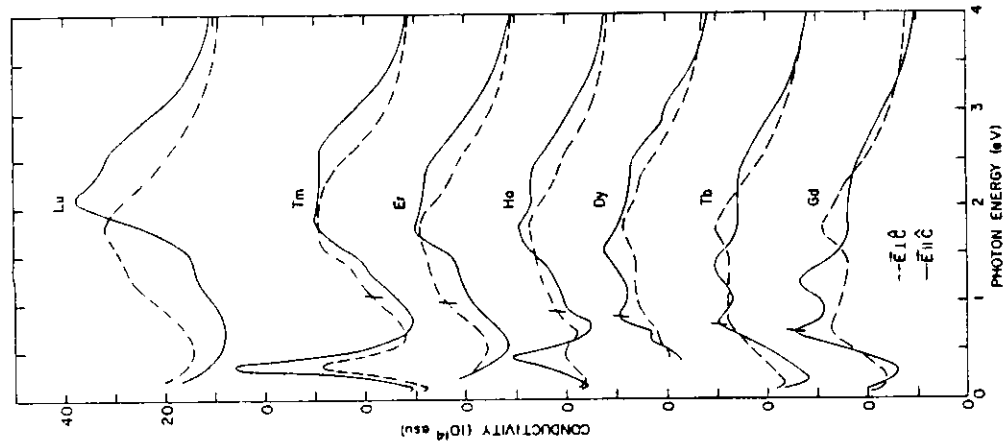

Fig. 93 Summary of the optical conductivity for the heavy rare earths reported by WL75 for single crystals at 4.2 K.

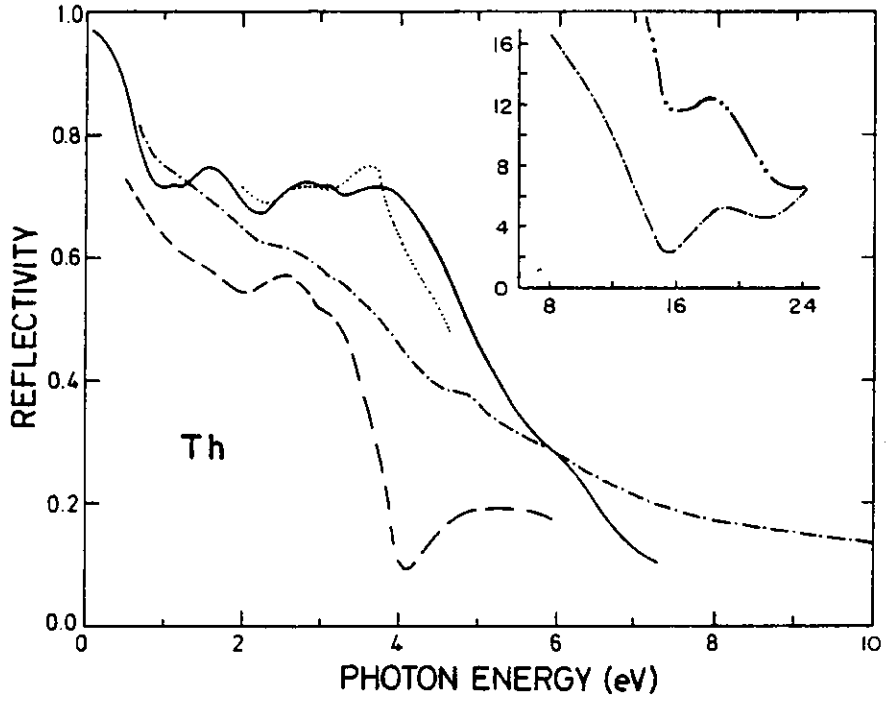

Fig. 95 Reflectivity for Th. Results by W077 (——); VKF73 (---); AN79 (···); and FN80 (—·—). Results by CGW80 (—··—) derived from electron energy loss measurements.

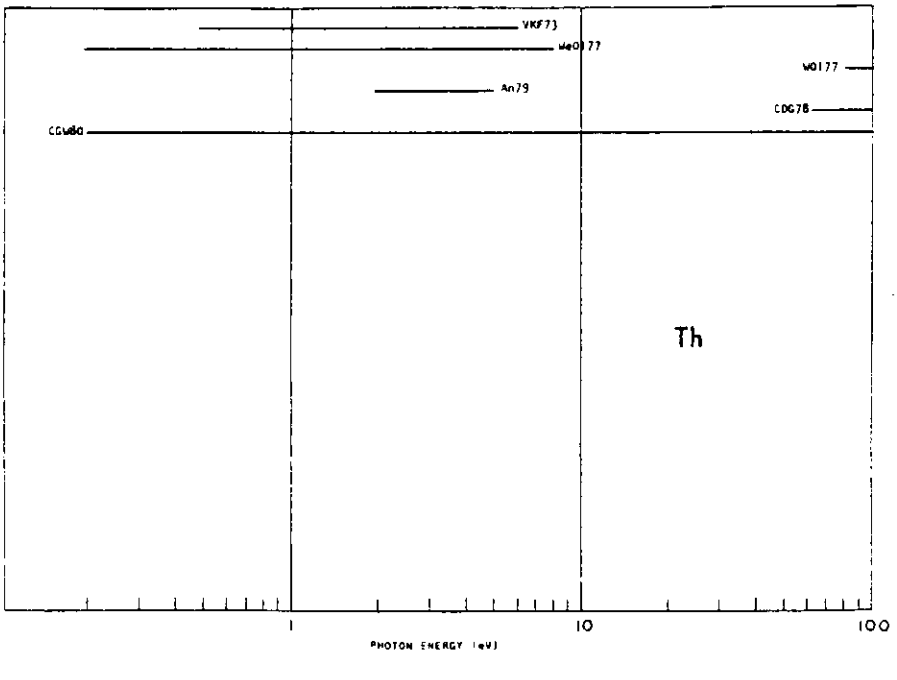

Fig. 94 Survey of available data on Th.

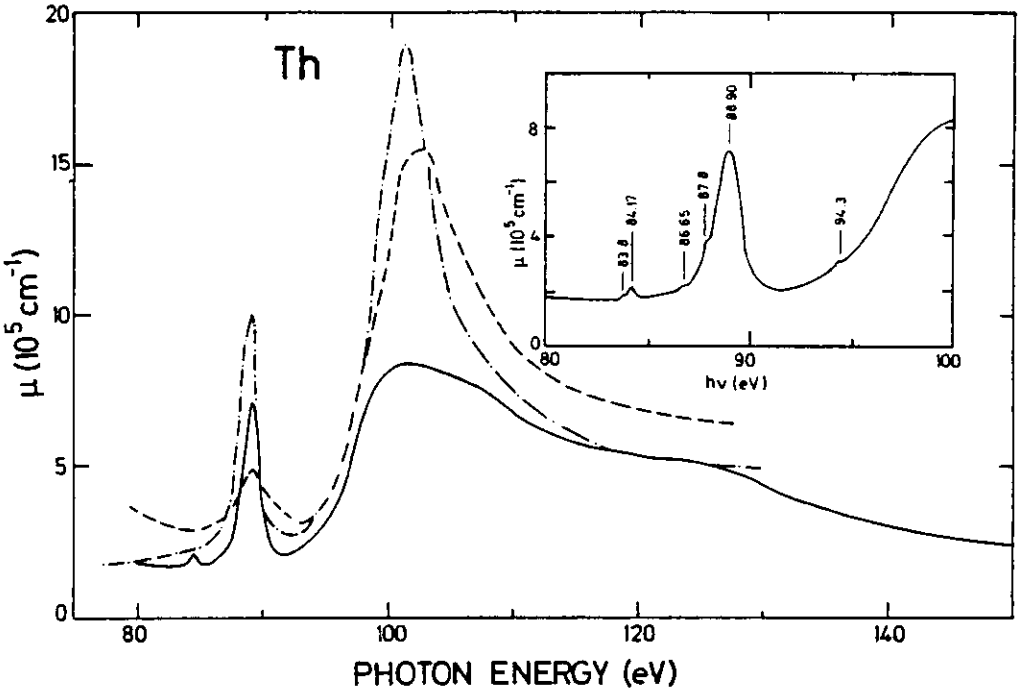

Fig. 97 Absorption coefficient for Th for 80 ≤ hν ≤ 150 eV. Results by W077 (——); CDG78 (---) derived from electron energy loss measurements and CDG78 (—·—) from soft x-ray absorption measurements.

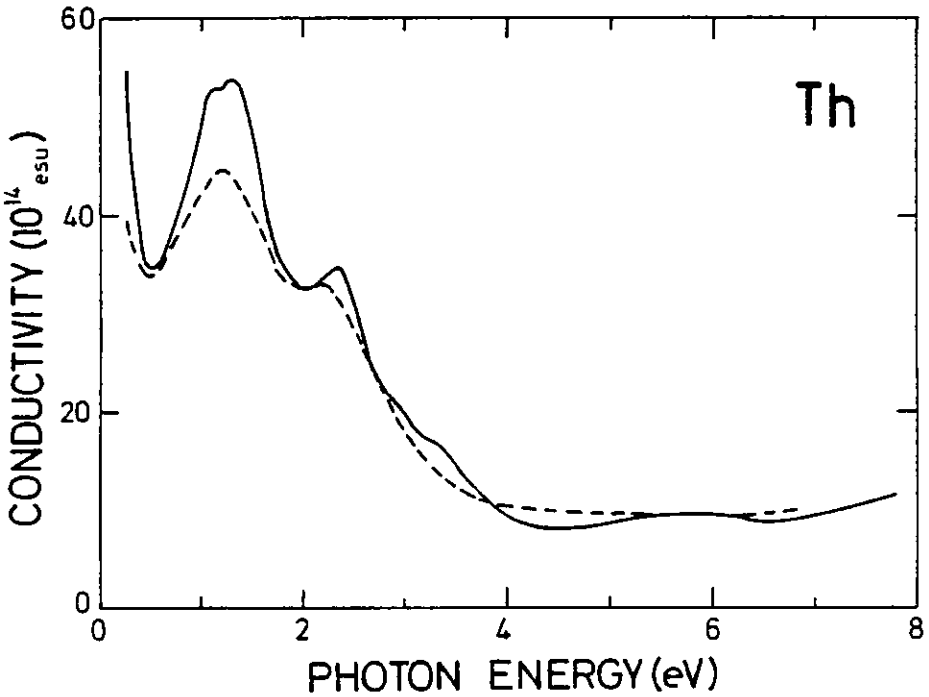

Fig. 96 Optical conductivity for Th. Results by W077 (——); and AN79 (---).

Thorium

publication by J.H. Weaver and C.G. Olson in Phys. Rev. B 15, 4602 (1977)
based on the following tabulation

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
0.10	-1392.69	1472.04	17.80	41.45	0.00	.965
0.12	-1107.83	998.54	13.85	36.05	0.00	.954
0.14	-894.59	782.27	10.97	32.01	0.00	.962
0.16	-737.83	512.76	9.96	28.60	0.00	.951
0.18	-609.05	386.45	7.49	25.80	0.00	.959
0.20	-507.86	296.76	6.34	23.41	0.00	.955
0.25	-332.91	175.50	4.66	18.83	0.00	.952
0.30	-228.43	117.46	3.77	15.58	0.00	.944
0.35	-162.20	80.75	3.04	13.19	0.00	.929
0.40	-120.93	73.56	3.21	11.46	0.00	.914
0.45	-91.80	64.13	3.14	10.09	0.01	.893
0.50	-72.54	56.10	3.10	9.06	0.01	.875
0.55	-58.88	51.08	3.13	8.16	0.01	.850
0.60	-45.58	47.74	3.20	7.47	0.01	.826
0.65	-37.02	45.37	3.28	6.91	0.01	.802
0.70	-30.54	43.59	3.37	6.47	0.02	.779
0.75	-25.57	42.39	3.46	6.13	0.02	.756
0.80	-22.15	41.29	3.52	5.87	0.02	.744
0.85	-18.87	40.55	3.60	5.64	0.02	.728
0.90	-16.91	40.34	3.66	5.51	0.02	.719
0.95	-15.70	40.17	3.70	5.42	0.02	.713
1.00	-15.32	39.99	3.71	5.39	0.02	.711
1.05	-15.62	39.57	3.67	5.39	0.02	.712
1.10	-16.61	38.97	3.56	5.41	0.02	.716
1.15	-17.94	38.66	3.42	5.36	0.02	.717
1.20	-18.84	38.19	3.33	5.26	0.02	.715
1.25	-17.10	34.12	3.25	5.26	0.02	.710
1.30	-17.81	32.90	3.13	5.26	0.02	.720
1.35	-18.66	31.22	2.97	5.25	0.02	.725
1.40	-19.13	29.84	2.82	5.20	0.02	.729
1.45	-19.63	27.26	2.64	5.16	0.02	.735
1.50	-19.77	25.09	2.47	5.09	0.02	.737
1.55	-19.73	22.73	2.28	4.99	0.03	.735
1.60	-19.05	20.46	2.11	4.85	0.03	.726
1.65	-18.04	18.58	1.98	4.69	0.03	.743
1.70	-16.93	17.09	1.89	4.53	0.03	.734
1.75	-15.81	15.93	1.82	4.37	0.03	.731
1.80	-14.77	14.91	1.76	4.23	0.04	.724
1.85	-13.83	14.55	1.78	4.09	0.04	.709
1.90	-13.17	14.00	1.74	4.03	0.04	.706
1.95	-12.45	13.40	1.71	3.92	0.04	.699
2.00	-11.76	13.02	1.70	3.83	0.04	.690
2.05	-11.24	12.73	1.69	3.76	0.04	.683
2.10	-10.78	12.51	1.69	3.69	0.05	.678
2.15	-10.44	12.40	1.70	3.65	0.05	.676
2.20	-10.31	12.24	1.69	3.63	0.05	.674
2.25	-10.20	12.07	1.67	3.61	0.05	.673
2.30	-10.23	11.92	1.65	3.60	0.05	.669
2.35	-10.46	11.83	1.61	3.61	0.05	.675

Energy (eV)	ε_1	ε_2	n	k	Im(-1/$\tilde{\varepsilon}$)	R(ϕ=0)
2.40	-10.70	11.85	1.54	3.82	0.05	.681
2.45	-10.89	10.57	1.48	3.61	0.05	.654
2.50	-10.92	9.73	1.36	3.57	0.05	.703
2.55	-10.75	8.99	1.29	3.52	0.05	.709
2.60	-10.51	8.34	1.21	3.45	0.05	.713
2.65	-10.24	7.72	1.14	3.38	0.05	.717
2.70	-9.89	7.17	1.04	3.33	0.05	.720
2.75	-9.53	6.70	1.03	3.25	0.05	.720
2.80	-9.17	6.28	0.99	3.18	0.05	.722
2.85	-8.81	5.92	0.95	3.12	0.05	.719
2.90	-8.47	5.64	0.92	3.05	0.05	.717
2.95	-8.19	5.40	0.89	3.00	0.06	.715
3.00	-7.91	5.09	0.87	2.94	0.06	.715
3.05	-7.65	4.81	0.83	2.89	0.06	.715
3.10	-7.36	4.55	0.80	2.83	0.06	.715
3.15	-7.05	4.35	0.79	2.77	0.06	.711
3.20	-6.78	4.20	0.77	2.72	0.07	.706
3.25	-6.55	4.07	0.76	2.67	0.07	.702
3.30	-6.36	3.95	0.75	2.63	0.07	.700
3.35	-6.24	3.79	0.73	2.60	0.07	.701
3.40	-6.10	3.59	0.70	2.57	0.07	.705
3.50	-5.76	3.19	0.64	2.48	0.07	.710
3.60	-5.38	2.83	0.59	2.39	0.08	.714
3.70	-4.99	2.50	0.54	2.30	0.08	.716
3.80	-4.57	2.23	0.51	2.20	0.09	.714
3.90	-4.18	2.01	0.48	2.10	0.09	.709
4.00	-3.80	1.84	0.46	2.06	0.10	.701
4.10	-3.43	1.72	0.45	1.91	0.12	.696
4.20	-3.12	1.64	0.45	1.82	0.13	.684
4.30	-2.84	1.59	0.44	1.74	0.15	.655
4.40	-2.56	1.49	0.45	1.66	0.17	.631
4.50	-2.32	1.42	0.45	1.59	0.19	.611
4.60	-2.07	1.39	0.46	1.51	0.22	.583
4.70	-1.86	1.38	0.48	1.45	0.26	.552
4.80	-1.69	1.38	0.49	1.39	0.29	.526
4.90	-1.50	1.38	0.52	1.33	0.33	.490
5.00	-1.37	1.38	0.54	1.28	0.37	.465
5.10	-1.24	1.38	0.55	1.24	0.40	.450
5.20	-1.13	1.37	0.57	1.20	0.44	.434
5.30	-1.02	1.36	0.58	1.17	0.47	.396
5.40	-0.92	1.35	0.60	1.13	0.50	.377
5.50	-0.84	1.34	0.61	1.10	0.54	.359
5.60	-0.75	1.32	0.62	1.07	0.57	.340
5.70	-0.67	1.31	0.63	1.04	0.60	.323
5.80	-0.61	1.30	0.64	1.01	0.63	.308
5.90	-0.55	1.28	0.65	0.99	0.66	.296
6.00	-0.49	1.26	0.65	0.96	0.69	.284
6.10	-0.43	1.23	0.66	0.93	0.73	.271
6.20	-0.37	1.19	0.66	0.90	0.77	.257
6.30	-0.30	1.16	0.67	0.86	0.81	.241
6.40	-0.23	1.13	0.68	0.83	0.85	.225
6.50	-0.16	1.11	0.69	0.80	0.89	.209
6.60	-0.07	1.09	0.72	0.76	0.91	.188
6.70	0.00	1.09	0.74	0.74	0.92	.173
6.80	0.07	1.08	0.76	0.71	0.92	.154
6.90	0.14	1.09	0.79	0.69	0.90	.142
7.00	0.19	1.11	0.81	0.68	0.88	.135

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks
				Film	X-tal	Bulk	Prep		U
WG74	50-140	Trans		x				μ	energy loss spectroscopy
CDG78	70-160	Trans		x				μ (absorption measurements); KK: μ (energy loss spectroscopy), $Im(\varepsilon^{-1})$	optical absorption measurements with synchrotron radiation; fast electron energy loss spectroscopy with KK analysis
CGW80	2-150	Trans		x				μ	fast electron energy loss spectroscopy
Wea80	0.15-2	Refl	4.2			x	EP	A	absorptivity measured by calorimetry on α-U
We Unpl	40-200	Trans		x				μ	soft x-ray absorption measurements

Th

Energy (eV)	ε_1	ε_2	n	k	$Im(-1/\tilde{\varepsilon})$	$R(\phi=0)$
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

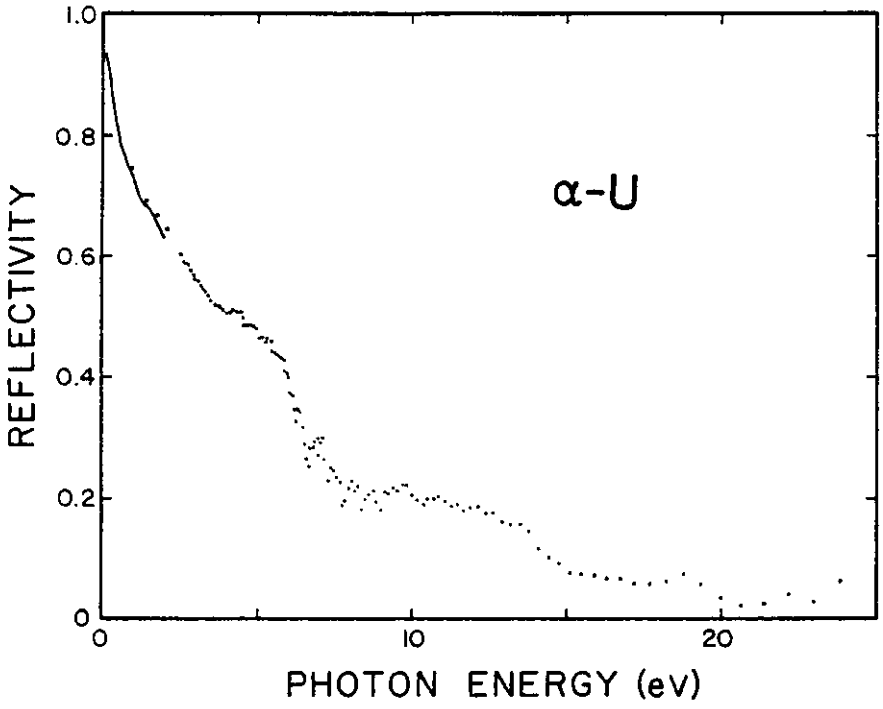

Fig. 99 Reflectivity for α-U. Polycrystalline results by Wea80 (——) and FNi80 (···).

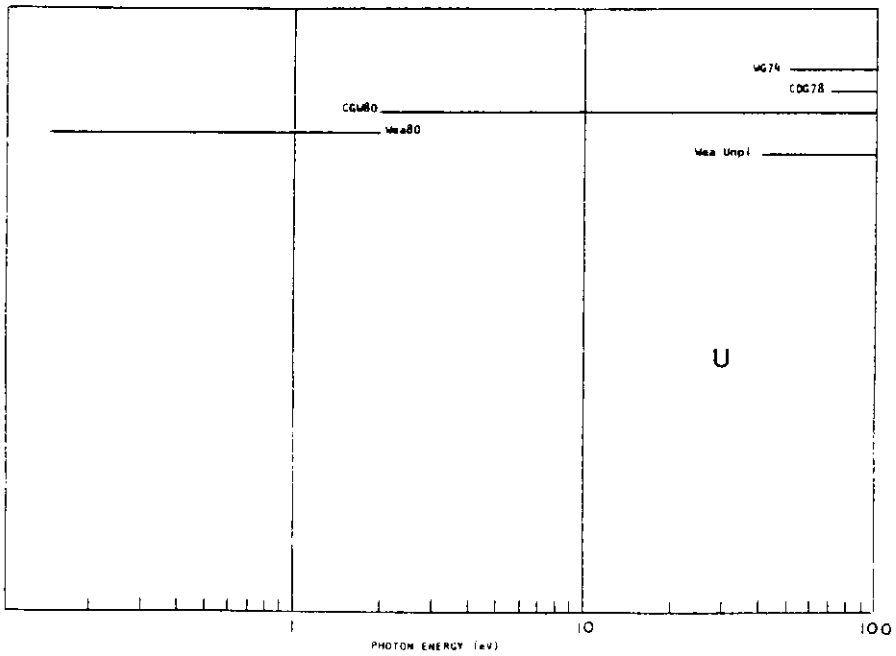

Fig. 98 Survey of available data on α-U.

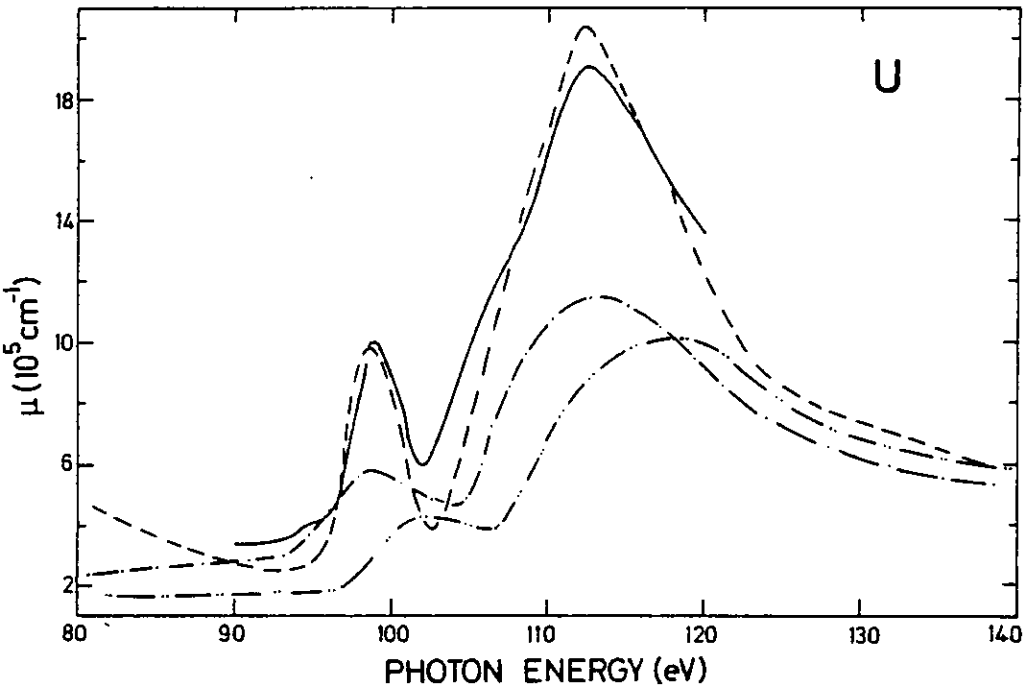

Fig. 101 Absorption coefficient for α-U for 80 ≤ hν ≤ 140 eV. Polycrystalline results by We Unpub (——) from soft x-ray absorption measurements; CDG78 from absorption measurements (— — —) and energy loss measurements (—·—); WG74 (—··—) from energy loss measurements.

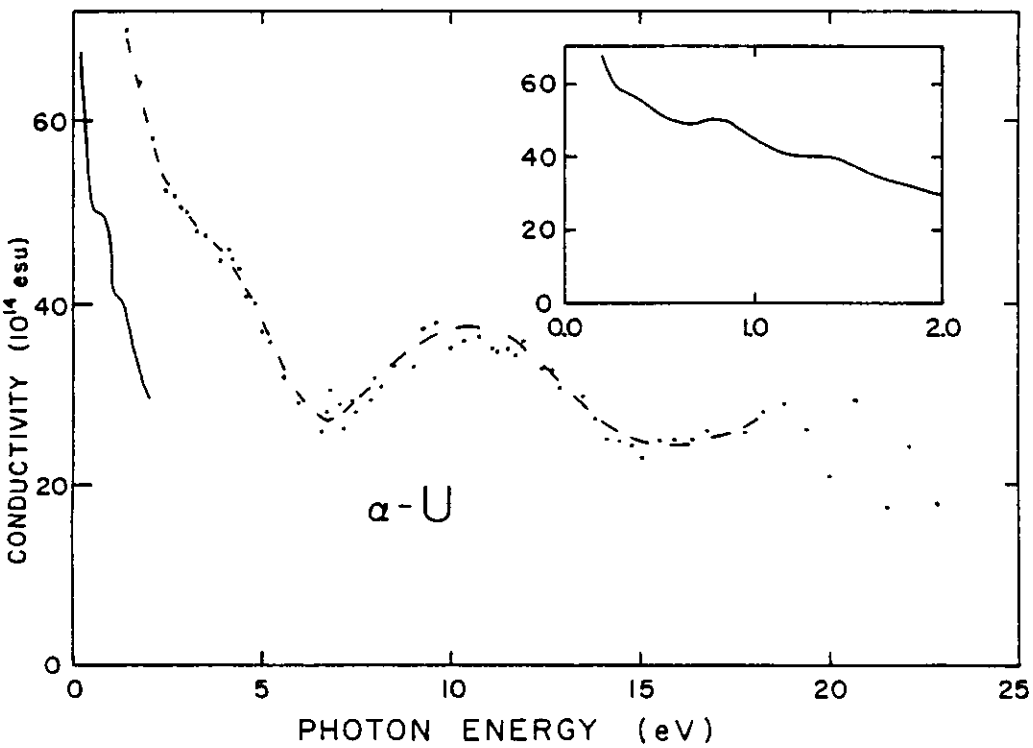

Fig. 100 Optical conductivity for α-U. Polycrystalline results by Wea80 (——) and FNi80 (···).

α-Uranium

from J.H. Weaver, J. Opt. Soc. Am. 70, 1030 (1980); dielectric function computed by KK analysis based on measurements over a limited spectral range. See reflectance spectrum for range of greatest reliability

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(φ=0)
0.10	-383.90	803.70	15.92	25.24	0.00	.931
0.15	-241.40	434.00	11.30	19.21	0.00	.913
0.20	-154.60	279.50	8.94	15.64	0.00	.898
0.25	-113.90	201.10	7.66	13.13	0.00	.876
0.30	-82.60	159.50	6.96	11.45	0.00	.857
0.35	-65.80	133.60	6.45	10.37	0.01	.842
0.40	-55.80	113.20	5.93	9.54	0.01	.829
0.45	-47.10	97.50	5.53	8.81	0.01	.816
0.50	-40.60	85.30	5.18	8.23	0.01	.804
0.55	-35.10	75.70	4.92	7.70	0.01	.791
0.60	-30.70	68.50	4.71	7.27	0.01	.780
0.65	-27.30	62.70	4.53	6.92	0.01	.769
0.70	-24.70	58.20	4.39	6.63	0.01	.760
0.75	-22.90	54.70	4.27	6.41	0.02	.752
0.80	-22.40	51.50	4.11	6.27	0.02	.744
0.85	-22.40	47.90	3.90	6.14	0.02	.737
0.90	-22.10	43.90	3.66	5.97	0.02	.728
0.95	-21.30	40.20	3.48	5.78	0.02	.720
1.00	-20.40	36.60	3.28	5.58	0.02	.711
1.05	-18.90	33.60	3.13	5.36	0.02	.702
1.10	-17.40	31.30	3.03	5.16	0.02	.717
1.15	-16.20	29.60	2.96	5.00	0.03	.709
1.20	-15.20	28.10	2.89	4.86	0.03	.701
1.25	-14.40	26.80	2.83	4.73	0.03	.695
1.30	-13.90	25.80	2.76	4.64	0.03	.690
1.35	-13.50	24.40	2.68	4.55	0.03	.687
1.40	-13.30	23.30	2.60	4.48	0.03	.685
1.45	-13.00	22.00	2.51	4.39	0.03	.683
1.50	-12.80	20.70	2.40	4.31	0.03	.681
1.55	-12.40	19.50	2.31	4.21	0.04	.678
1.60	-11.90	18.40	2.24	4.11	0.04	.673
1.65	-11.40	17.40	2.17	4.01	0.04	.668
1.70	-11.00	16.40	2.09	3.92	0.04	.664
1.75	-10.50	15.60	2.04	3.83	0.04	.659
1.80	-10.10	14.80	1.98	3.74	0.05	.654
1.85	-9.63	14.10	1.93	3.65	0.05	.648
1.90	-9.22	13.50	1.89	3.58	0.05	.643
1.95	-8.85	12.70	1.82	3.49	0.05	.638
2.00	-8.50	12.30	1.80	3.42	0.06	.632

α-Uranium

from A. Fäldt and P.O. Nilsson, J. Phys. F 10, 2573 (1980)

Energy (eV)	ε_1	ε_2	n	k	Im(-1/ε)	R(φ=0)
0.95	-14.49	71.17	5.39	6.60	0.01	.744
1.41	-11.39	41.60	3.95	5.19	0.02	.693
1.77	-10.82	29.91	3.24	4.62	0.03	.670
2.07	-9.36	23.16	2.80	4.14	0.04	.646
2.48	-6.91	17.47	2.44	3.58	0.05	.605
2.64	-6.11	16.24	2.37	3.42	0.05	.589
2.70	-6.07	15.61	2.33	3.39	0.06	.587
2.76	-5.99	15.22	2.29	3.34	0.06	.584
2.82	-5.62	14.76	2.25	3.27	0.06	.577
2.88	-5.63	14.35	2.21	3.24	0.06	.575
2.95	-5.27	13.75	2.17	3.16	0.06	.567
3.02	-4.99	13.40	2.16	3.11	0.07	.560
3.10	-4.85	12.98	2.12	3.06	0.07	.556
3.18	-4.60	12.54	2.09	3.00	0.07	.549
3.22	-4.49	12.37	2.08	2.97	0.07	.545
3.26	-4.46	12.20	2.06	2.96	0.07	.544
3.31	-4.28	11.95	2.05	2.91	0.07	.539
3.35	-4.26	11.76	2.03	2.90	0.08	.538
3.40	-4.08	11.54	2.02	2.86	0.08	.533
3.44	-4.01	11.41	2.01	2.84	0.08	.530
3.50	-3.86	11.20	2.00	2.80	0.08	.525
3.60	-3.67	10.94	1.98	2.76	0.08	.519
3.65	-3.55	10.68	1.99	2.74	0.08	.516
3.67	-3.54	10.69	1.99	2.74	0.08	.516
3.71	-3.46	10.87	1.99	2.73	0.08	.514
3.76	-3.35	11.50	2.08	2.77	0.08	.515
3.87	-3.55	8.15	1.63	2.49	0.10	.503
3.92	-3.62	9.53	1.81	2.63	0.09	.511
3.97	-3.32	9.41	1.82	2.58	0.09	.501
4.03	-3.44	9.52	1.83	2.60	0.09	.505
4.08	-3.56	9.35	1.80	2.61	0.09	.509
4.13	-3.52	9.21	1.78	2.59	0.09	.506
4.19	-3.69	9.03	1.74	2.59	0.09	.511
4.22	-3.72	8.83	1.71	2.58	0.10	.511
4.28	-3.51	8.59	1.70	2.53	0.10	.503
4.34	-3.61	8.47	1.67	2.53	0.10	.506
4.40	-3.64	8.23	1.64	2.51	0.10	.507
4.43	-3.73	8.09	1.61	2.51	0.10	.510
4.46	-3.59	7.94	1.60	2.48	0.10	.504
4.49	-3.64	7.83	1.55	2.46	0.11	.506
4.53	-3.36	7.43	1.55	2.40	0.11	.495
4.56	-3.24	7.43	1.56	2.38	0.11	.489
4.59	-3.13	7.43	1.57	2.37	0.11	.485
4.63	-3.30	7.45	1.56	2.39	0.11	.492
4.66	-3.35	7.25	1.52	2.38	0.11	.494
4.70	-3.18	7.13	1.52	2.34	0.12	.486
4.73	-3.30	7.20	1.52	2.37	0.11	.492

α-U

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
4.77	-3.16	6.93	1.49	2.32	0.12	.486
4.81	-3.16	6.89	1.49	2.32	0.12	.485
4.84	-3.19	6.77	1.46	2.31	0.12	.497
4.88	-3.11	6.83	1.45	2.26	0.12	.483
4.92	-3.16	6.46	1.42	2.28	0.12	.486
4.96	-3.02	6.25	1.40	2.23	0.13	.479
5.00	-2.86	6.19	1.41	2.20	0.13	.471
5.04	-2.75	6.24	1.43	2.19	0.13	.465
5.08	-2.90	6.20	1.40	2.21	0.13	.473
5.12	-2.94	6.02	1.37	2.20	0.13	.475
5.17	-2.79	5.84	1.36	2.15	0.14	.467
5.21	-2.79	5.70	1.33	2.14	0.14	.466
5.25	-2.63	5.64	1.34	2.10	0.15	.459
5.30	-2.69	5.62	1.33	2.11	0.14	.462
5.34	-2.76	5.47	1.30	2.11	0.15	.466
5.44	-2.64	5.06	1.23	2.04	0.16	.461
5.49	-2.35	4.88	1.24	1.97	0.17	.443
5.54	-2.27	4.91	1.25	1.96	0.17	.438
5.59	-2.31	4.80	1.23	1.95	0.17	.441
5.64	-2.13	4.75	1.24	1.91	0.18	.429
5.69	-2.23	4.66	1.21	1.92	0.17	.436
5.74	-2.19	4.52	1.19	1.90	0.18	.434
5.79	-2.17	4.36	1.17	1.86	0.18	.433
5.85	-2.11	4.11	1.12	1.84	0.19	.430
5.90	-1.88	4.01	1.13	1.78	0.20	.412
5.96	-1.83	3.89	1.11	1.75	0.21	.409
6.02	-1.69	3.71	1.09	1.70	0.22	.398
6.08	-1.40	3.66	1.12	1.63	0.24	.373
6.14	-1.37	3.56	1.10	1.61	0.24	.371
6.20	-1.12	3.47	1.12	1.54	0.26	.347
6.26	-0.88	3.56	1.18	1.51	0.26	.328
6.33	-1.05	3.69	1.18	1.56	0.25	.344
6.39	-1.07	3.44	1.12	1.53	0.27	.343
6.46	-0.82	3.22	1.12	1.44	0.29	.318
6.53	-0.51	3.15	1.16	1.36	0.31	.289
6.60	-0.20	3.21	1.23	1.31	0.31	.264
6.67	0.07	3.47	1.33	1.30	0.29	.254
6.74	-0.22	3.81	1.34	1.42	0.26	.285
6.81	-0.27	3.69	1.31	1.41	0.27	.284
6.89	-0.42	3.61	1.27	1.42	0.27	.293
6.97	-0.20	3.51	1.29	1.36	0.28	.274
7.05	-0.37	3.65	1.29	1.42	0.27	.290
7.13	-0.61	3.36	1.18	1.42	0.29	.302
7.21	-0.30	2.98	1.16	1.28	0.33	.265
7.29	0.14	3.00	1.25	1.20	0.33	.230
7.38	0.01	3.29	1.28	1.28	0.30	.251
7.47	-0.02	3.13	1.25	1.25	0.32	.247
7.56	0.09	3.02	1.25	1.21	0.33	.234
7.65	0.10	2.90	1.22	1.18	0.34	.229
7.75	0.56	2.76	1.30	1.06	0.35	.190
7.85	0.75	3.10	1.40	1.10	0.31	.197
7.95	0.61	3.35	1.42	1.18	0.29	.217
8.05	0.38	3.30	1.36	1.21	0.30	.227
8.16	0.49	3.12	1.35	1.16	0.31	.213
8.27	0.31	3.03	1.29	1.17	0.33	.219
8.38	0.75	2.81	1.35	1.04	0.33	.182
8.49	0.83	3.18	1.44	1.11	0.29	.196

α-U

Energy (eV)	ϵ_1	ϵ_2	n	k	Im(-1/$\tilde{\epsilon}$)	R(ϕ=0)
8.61	0.69	3.26	1.42	1.15	0.29	.208
8.73	0.52	3.14	1.37	1.16	0.31	.213
8.86	0.66	2.94	1.36	1.08	0.32	.194
8.99	1.02	3.01	1.45	1.04	0.30	.181
9.12	0.91	3.42	1.47	1.16	0.29	.211
9.25	0.74	3.29	1.43	1.15	0.29	.208
9.39	0.60	3.34	1.41	1.18	0.29	.217
9.54	0.57	3.23	1.39	1.16	0.30	.213
9.69	0.43	3.25	1.36	1.19	0.30	.222
9.84	0.31	3.07	1.30	1.18	0.32	.221
10.00	0.42	2.87	1.29	1.11	0.34	.205
10.16	0.50	2.84	1.30	1.09	0.34	.198
10.33	0.55	2.86	1.32	1.09	0.34	.195
10.51	0.50	2.89	1.31	1.10	0.34	.200
10.69	0.45	2.84	1.29	1.10	0.34	.201
10.88	0.37	2.77	1.26	1.10	0.36	.203
11.07	0.37	2.63	1.23	1.07	0.37	.196
11.27	0.43	2.56	1.23	1.04	0.38	.188
11.48	0.37	2.54	1.21	1.05	0.39	.191
11.70	0.45	2.43	1.21	1.01	0.40	.179
11.92	0.39	2.47	1.20	1.03	0.39	.186
12.16	0.29	2.35	1.15	1.02	0.42	.187
12.40	0.33	2.21	1.13	0.98	0.44	.177
12.65	0.29	2.13	1.10	0.97	0.46	.176
12.92	0.34	1.99	1.09	0.92	0.49	.163
13.19	0.37	1.93	1.08	0.89	0.50	.157
13.48	0.31	1.84	1.04	0.88	0.53	.157
13.78	0.31	1.63	0.99	0.82	0.59	.145
14.09	0.48	1.46	1.00	0.73	0.62	.117
14.42	0.60	1.42	1.03	0.69	0.60	.103
14.76	0.64	1.36	1.04	0.66	0.60	.094
15.12	0.80	1.26	1.07	0.59	0.56	.076
15.50	0.89	1.32	1.11	0.59	0.52	.075
15.90	0.92	1.31	1.12	0.58	0.51	.073
16.32	0.97	1.26	1.13	0.56	0.50	.069
16.76	0.98	1.26	1.14	0.56	0.49	.068
17.22	1.04	1.19	1.14	0.52	0.48	.060
17.71	1.13	1.20	1.18	0.51	0.44	.058
18.24	1.16	1.28	1.20	0.53	0.43	.063
18.79	0.96	1.35	1.15	0.59	0.49	.075
19.37	0.88	1.09	1.07	0.51	0.56	.058
20.00	1.01	0.87	1.08	0.40	0.49	.037
20.67	1.15	0.80	1.13	0.35	0.41	.030
21.38	1.35	0.67	1.19	0.28	0.30	.024
22.14	1.51	0.91	1.28	0.36	0.29	.039
22.96	1.56	0.65	1.27	0.26	0.23	.027
23.85	1.94	1.25	1.46	0.43	0.23	.063

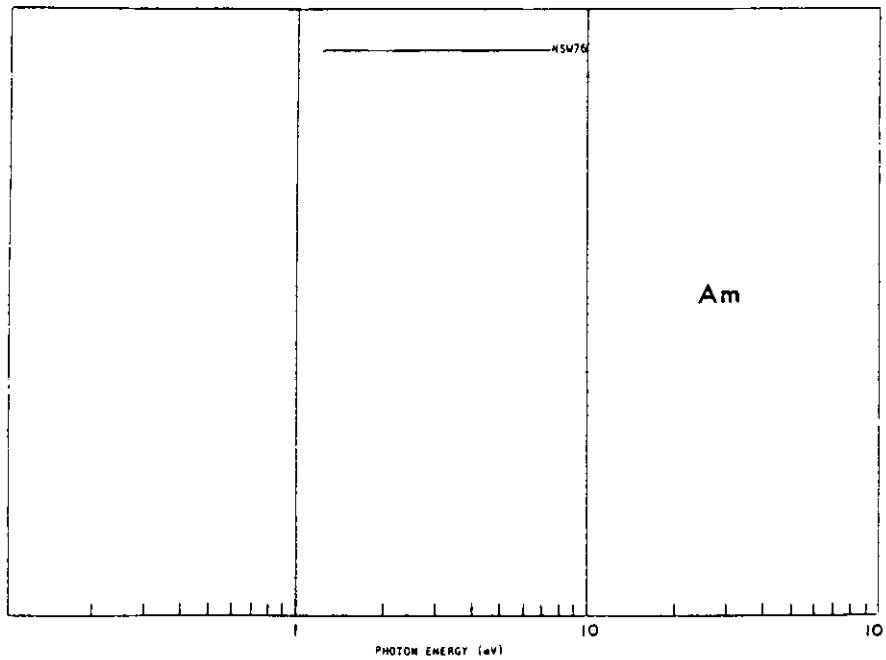

Fig. 102 Survey of available data on Am.

Authors	Energy Range (eV)	Technique	Temperature (K) RT unless specified	Sample				Data Presentation	Remarks Am
				Film	X-tal	Bulk	Prep		
NSW76	1.27-7.51	Refl		x				R,n,k	plotted R corrected for window reflectivity

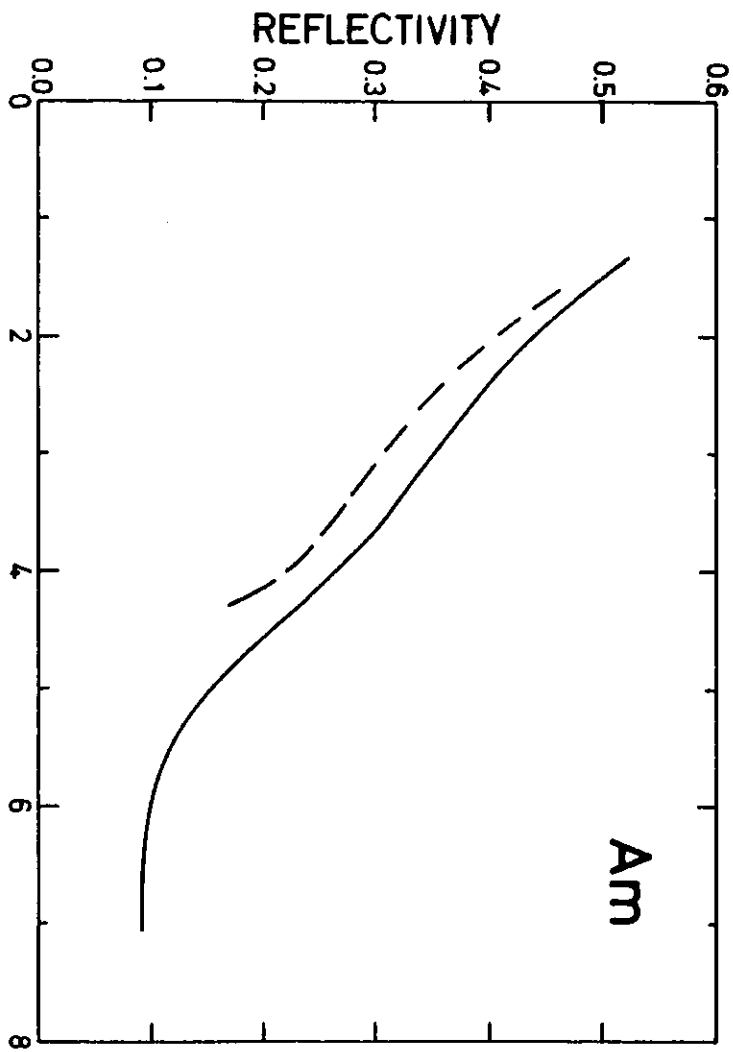

Fig. 103 Reflectivity for Am. Polycrystalline results by NSW76 using films evaporated onto Al_2O_3 (——) and SiO_2 (---).

BIBLIOGRAPHY

AKB80 D.E. Aspnes, E. Kinsbron, and D.D. Bacon
Optical properties of Au: Sample effects
Phys. Rev. B 21, 3290 (1980)

Aks74 L.N. Aksyntov
Normal spectral emissivity of gold, platinum, and tungsten
Inzh.-Fiz. Zh. 27, 197 (1974)

AN79 C. Alvani and J. Naegele
Optical reflectivity measurements on thorium metal samples
J. Physique 40, C4-131 (1979)

BB66 H.E. Bennett and J.M. Bennett
Validity of the Drude theory for silver, gold and aluminum in the infrared
Optical Properties and Electronic Structure of Metals and Alloys
ed. by F. Abélès (North Holland Publishing Co. Amsterdam, 1966)
p. 175

BBA68 H.E. Bennett, J.M. Bennett, E.J. Ashley, and R.J. Motyka
Verification of the anomalous-skin-effect theory for silver in the infrared
Phys. Rev. 165, 755 (1968)

BBS71 E.A. Bakulin, L.A. Balabanova, E.V. Stepin, and V.V. Shcherbinina
Characteristic energy losses of electrons in the rare-earth metals Ho, Er, Tm, and Yb
Soviet Phys. Solid State 13, 189 (1971)
Fiz. Tverd. Tela. 13, 241 (1971)

BCF75 B. Brousseau-Lahaye, C. Colliex, J. Frandon, M. Gasgnier, and P. Trebbia
Determination of the electron excitation spectrum in scandium and yttrium by means of characteristic energy loss measurements
Phys. Stat. Solidi B 69, 257 (1975)

BCT79 D. Beaglehole, M. DeCrescenzi, M.L. Thèye, and G. Vuye
Dielectric constant of gold, copper, and gold-copper alloys between 18 and 35 eV
Phys. Rev. B 19, 6303 (1979)

Bea55 J.R. Beattie
Optical constants in the infrared - experimental methods
Phil. Mag. 46, 235 (1955)

Bea57 J.R. Beattie
The anomalous skin effect and the infrared properties of silver and aluminum
Physica 23, 898 (1957)

BIBLIOGRAPHY (cont'd)

Bea65 D. Beaglehole
Optical properties of copper and gold in the vacuum ultraviolet
Proc. Phys. Soc. 85, 1007 (1965)

Ben Unpub R.L. Benbow
Unpublished

BG68 M.A. Biondi and A.I. Guobadia
Infrared absorption of aluminum, copper, lead, and nickel at 4.2 K
Phys. Rev. 166, 667 (1968)

BHM60 P.H. Berning, G. Hass, and R.P. Madden
Reflectance-increasing coatings for the vacuum ultraviolet and their applications
J. Opt. Soc. Am. 50, 586 (1960)

BHM73 L.G. Bernland, O. Hunderi, and H.P. Myers
Optical absorption in vapor-quenched aluminum
Phys. Rev. Lett. 31, 363 (1973)

Bio56 M.A. Biondi
Optical absorption of copper and silver at 4.2 K
Phys. Rev. 102, 964 (1956)

BKB76 D.N. Baria, T.S. King, and R.G. Bautista
The normal spectral emittance of yttrium, lanthanum, cerium, praseodymium, and neodymium above 1000 K
Metall. Trans. B 7, 577 (1976)

BKS74 C. Bonnelle, R.C. Karnatak, and J. Sugar
Photoabsorption in the vicinity of 3d absorption edges of La, La_2O_3, Ce and CeO_2
Phys. Rev. A 9, 1920 (1974)

BL75 R.L. Benbow and D.W. Lynch
Optical absorption in Al and dilute alloys of Mg and Li in Al at 4.2 K
Phys. Rev. B 12, 5615 (1975)

BoL70 L.W. Bos and D.W. Lynch
Low-energy optical absorption peak in aluminum and Al-Mg alloys
Phys. Rev. Lett. 25, 156 (1970)

BSA63 H.E. Bennett, M. Silver, and E.J. Ashley
Infrared reflectance of aluminum evaporated in ultra-high vacuum
J. Opt. Soc. Am. 53, 1089 (1963)

BSY66 A.J. Blodgett, Jr., W.E. Spicer, and A.Y-C. Yu
The band structure of gadolinium; photoemission and optical studies
Optical Properties and Electronic Structure of Metals and Alloys
ed. by F. Abelès (North Holland Publishing Co., Amsterdam, 1966)
p. 246

BIBLIOGRAPHY (cont'd)

BT77 D. Beaglehole and B. Thiéblemont
Direct determination of optical constants and the d absorption of Au, Cu, and AuCu alloys
Il Nuovo Cimento B 39, 477 (1977)

CDG78 M. Cukier, P. Dhez, B. Gauthé, P. Jaeglé, Cl. Wehenkel, and F. Combet Farnoux
Photoabsorption of Th and U by direct measurement and by fast electron energy loss spectra near the 5d thresholds
J. Physique 39, L315 (1978)

CEP65 B.R. Cooper, H. Ehrenreich, and H.R. Philipp
Optical properties of noble metals. II.
Phys. Rev. 138, A494 (1965)

CGT76 C. Colliex, M. Gasgnier, and P. Trebbia
Analysis of the electron excitation spectra in heavy rare earth metals, hydrides, and oxides
J. Physique 37, 397 (1976)

CGT79 K.T. Chee, F.E. Girouard, and V.V. Truong
Optical behavior of yttrium films in ultrahigh vacuum
Appl. Optics 18, 1702 (1979)

CGW80 M. Cukier, B. Gauthé, and C. Wehenkel
Interband, collective and atomic (p,d) excitations from 2 to 160 eV in Sc, Y, lanthanides and actinides and in some of their compounds by FEELS
Private communication, to be published

CHH64 L.R. Canfield, G. Hass, and W.R. Hunter
The optical properties of evaporated gold in the vacuum ultraviolet from 300 Å to 2000 Å
J. Physique 25, 124 (1964)

CK73 R. Chander and R. Kumar
Optical absorption in vacuum-evaporated ytterbium films
Phys. Stat. Sol. B 20, 739 (1973)

Cle Pvt B. Cleyet
private communication with J.P. Pétraklan referenced in Pet74

CR65 B.R. Cooper and R.W. Redington
Infrared absorption structure in rare earth metals: relationship to spin arrangement and band structure
Phys. Rev. Lett. 14, 1066 (1965)

Dan67 J. Daniels
Energieverlustmessungen an Silber mit hoher Energieauflosung
Z. Physik 203, 235 (1967)

BIBLIOGRAPHY (cont'd)

Dan69 J. Daniels
Bestimmung von optischen Konstanten von Palladium und Silber aus Energieverlustmessungen im Energiebereich von 2 bis 90 eV
Z. Physik 227, 234 (1969)

Dan71 J. Daniels
Bestimmung optischen Konstanten von Gadolinium und Dysprosium durch Energieverlustmessungen von 60 keV Elektronen
Optics Comm. 3, 13 (1971)

DFR70 J. Daniels, C.V. Festenberg, H. Raether, and K. Zeppenfeld
Optical constants of solids by electron spectroscopy
Springer Tracts in Modern Physics, Vol. 54, ed. by G. Höhler (Springer-Verlag, Berlin, 1970) p. 77

DH64 L.F. Drummeter, Jr. and G. Hass
Solar absorptance and thermal emittance of evaporated coatings
Physics of Thin Films, Vol. 2 (Academic Press, Inc., New York, 1964) p. 305

DoM65 B. Dold and R. Mecke
Optische Eigenschaften von Edelmetallen, Übergangsmetallen und deren Legierungen im Infrarot
Optik 22, 435 (1965)

EBF74 J.L. Erskine, G.A. Blake, and C.J. Flaten
Optical properties of Gd, Dy, and Tb
J. Opt. Soc. Am. 64, 1332 (1974)

EF76 J.L. Erskine and C.P. Flynn
Measurement of the 4f shell optical edge in Gd metal
Phys. Rev. B 14, 2197 (1976)

EPS63 H. Ehrenreich, H.R. Philipp, and B. Segall
Optical properties of aluminum
Phys. Rev. 132, 1918 (1963)

ErS73 J.L. Erskine and E.A. Stern
Magneto-optic Kerr effects in gadolinium
Phys. Rev. B 8, 1239 (1973)

ES70 J.G. Endriz and W.E. Spicer
Reflectance studies of Ba, Sr, Eu, and Yb
Phys. Rev. B 2, 1466 (1970)

FDS77 L.A. Feldkamp, L.C. Davis, and M.B. Stearns
Analysis of electron inelastic-scattering data with application to Cu
Phys. Rev. B 15, 5535 (1977)

BIBLIOGRAPHY (cont'd)

FL67 V.A. Fomichev and A.P. Lukirskii
Absorption coefficients of aluminum in the 23.6-410 Å range of ultrasoft x-radiation
Opt. Spectrosc. 22, 432 (1967)
Opt. Spektrosk. 22, 796 (1966)

FLS75 N. Fuschillo, B. Lalevic, W. Slusark, Jr., and A. Delahoy
Optical properties of thin Au-Cr films and their application to solar energy conversion
J. Vac. Sci. Technol. 12, 84 (1975)

FNi80 A. Fäldt and P.O. Nilsson
Optical properties of uranium in the range 0.6-25 eV
J. Phys. F: Metal Physics 10, 2573 (1980)

FN80 A. Fäldt and P.O. Nilsson
Optical properties of thorium in the range 0.5-25 eV
Phys. Rev. B 22, 1740 (1980)

FS66 H. Fukutani and O. Sueoka
Optical Properties of Ag-Au Alloys
Optical Properties and Electronic Structure of Metals and Alloys ed. by F. Abelès (North Holland Publishing Co., Amsterdam, 1966) p. 564

FS75 C.J. Flaten and E.A. Stern
Optical constants of some silver alloys
Phys. Rev. B 11, 638 (1975)

FZG67 V.A. Fomichev, T.M. Zimkina, S.A. Gribovskii, and I.I. Zhukova
Discrete absorption by 4d electrons in the lanthanum group rare-earth metals
Sov. Phys. Solid State 9, 1163 (1967)
Fiz. Tverd. Tela. 9, 1490 (1967)

GB70 C. Gähwiller and F.C. Brown
Photoabsorption near the $L_{II,III}$ edge of silicon and aluminum
Phys. Rev. B 2, 1918 (1970)

GH76 C.G. Granqvist and O. Hunderi
Optical absorption in ultrafine gold particles
Solid State Comm. 19, 939 (1976)

GK72 W. Gudat and C. Kunz
Close similarity between photoelectric yield and photoabsorption spectra in the soft x-ray range
Phys. Rev. Lett. 29, 169 (1972)

BIBLIOGRAPHY (cont'd)

GMS60 A.I. Golovashkin, G.P. Motulevich, and A.A. Shubin
Determination of microscopic parameters of aluminum from its optical constants and electric conductivity
Sov. Phys. JETP 11, 38 (1960)
J. Exptl. Theoret. Phys. (USSR) 38, 51 (1960)

GZN78 V.P. Gnezdilov, N.M. Zvyagina, G.S. Nikol'skii, V.V. Eremenko, and A.B. Beznosov
Optical properties of bulk gadolinium in the range 0.5-3.1 eV
Sov. J. Low Temp. Phys. 4, 606 (1978)
Fiz. Nizk. Temp. 4, 1286 (1978)

HAM64 R.H. Huebner, E.T. Arakawa, R.A. MacRae, and R.N. Hamm
Optical constants of vacuum-evaporated silver films
J. Opt. Soc. Am. 54, 1434 (1964)

Has63 G. Hass
in American Institute of Physics Handbook
(McGraw-Hill Book Company, Inc., New York, 1963) Chapter 6, p. 119

HC69 J.N. Hodgson and B. Cleyet
Absorption bands of gadolinium in the ferromagnetic and paramagnetic states
J. Phys. C: Solid State Phys. 2, 97 (1969)

HCN73 J.H. Halford, F.K. Chin, and J.E. Norman
Effects of vacuum deposition conditions on ellipsometric parameters, optical constants, and reflectance of ultrapure aluminum films
J. Opt. Soc. Am. 63, 786 (1973)

HGK74 H.J. Hagemann, W. Gudat, and C. Kunz
Optical constants from the far infrared to the x-ray region: Mg, Al, Cu, Ag, Au, Bi, C, and Al_2O_3
DESY SR-74/7, Hamburg (1974)

HGK75 H.J. Hagemann, W. Gudat, and C. Kunz
Optical constants from the far infrared to the x-ray region: Mg, Al, Cu, Ag, Au, Bi, C, and Al_2O_3
J. Opt. Soc. Am. 65, 742 (1975)

HGK76 H.J. Hagemann, W. Gudat, and C. Kunz
Photoabsorption coefficient of alloys of Al with transition metals V, Fe, Ni and with Cu and Pr from 30 eV to 150 eV photon energy
Phys. Stat. Sol. B 74, 507 (1976)

HKL77 T. Hollstein, U. Kreibig, and F. Leis
Optical properties of Au and Al in the visible, determined at 300 and 1.5 K
Phys. Stat. Sol. B 83, 449 (1977)

BIBLIOGRAPHY (cont'd)

HKS68 R. Haensel, C. Kunz, T. Sasaki, and B. Sonntag
Absorption measurements of copper, silver, tin, gold, and bismuth in the far ultraviolet
Appl. Optics 7, 301 (1968)

HKS70 R. Haensel, G. Keitel, B. Sonntag, C. Kunz, and P. Schreiber
Photoabsorption measurement of Li, Be, Na, Mg, and Al in the XUV range
Phys. Stat. Sol. A 2, 85 (1970)

Ho55 J.N. Hodgson
The infra-red properties of some metallic films
Proc. Phys. Soc. B 68, 593 (1955)

Ho68 J.N. Hodgson
The optical properties of gold
J. Phys. Chem. Solids 29, 2175 (1968)

HRS70 R. Haensel, P. Rabe, and B. Sonntag
Optical absorption of cerium, cerium oxide, praseodymium, praseodymium oxide, neodymium, neodymium oxide, and samarium in the extreme ultraviolet
Solid State Comm. 8, 1845 (1970)

HSK69 R. Haensel, B. Sonntag, C. Kunz, and T. Sasaki
Contribution of L shell to the total absorption cross section in aluminum
J. Appl. Phys. 40, 3046 (1969)

Hu71 W.R. Hunter
Comparison of the VUV reflectance spectra of evaporated films of some second and third series transition metals for wavelengths less than 2000 Å
Proc. III Int. Conf. Vac. Ultraviolet Rad. Physics, Tokyo (1971)

Hun64 W.R. Hunter
Optical constants of metals in the extreme ultraviolet. II. Optical constants of aluminum, magnesium, and indium at wavelengths shorter than their critical wavelengths
J. Opt. Soc. Am. 54, 208 (1964)

Hun73 O. Hunderi
Partial disorder in evaporated aluminum films
Solid State Comm. 12, 237 (1973)

Hun Unpub O. Hunderi
Unpublished

BIBLIOGRAPHY (cont'd)

HW61 G. Hass and J.E. Waylonis
Optical constants and reflectance and transmittance of evaporated aluminum in the visible and ultraviolet
J. Opt. Soc. Am. 51, 719 (1961)

IHW71 G.B. Irani, T. Huen, and F. Wooten
Optical constants of silver and gold in the visible and vacuum ultraviolet
J. Opt. Soc. Am. 61, 128 (1971)

IHW72 G.B. Irani, T. Huen, and F. Wooten
Optical properties of gold and α-phase gold-aluminum alloys
Phys. Rev. B 6, 2904 (1972)

IrH71 G.B. Irani, T. Huen, and F. Wooten
Optical properties of Ag and α-phase Ag-Al alloys
Phys. Rev. B 3, 2385 (1971)

JC72 P.B. Johnson and R.W. Christy
Optical constants of noble metals
Phys. Rev. B 6, 4370 (1972)

JC75 P.B. Johnson and R.W. Christy
Optical constants of copper and nickel as a function of temperature
Phys. Rev. B 11, 1315 (1975)

JK54 G. Joos and A. Klopfer
Die Temperatureabhängigkeit der optischen Konstanten von Cu, Ag und Au bis herab zu 20 K
Z. Physik 138, 251 (1954)

JM66 P. Jaegle and G. Missoni
Coefficient d'absorption massique de l'or dans la région de longuer d'onde de 26 à 120 Å
C.R. Acad. Sc. Paris 262, 71 (1966)

Ker56 E. Kern
Die Bestimmung der optischen Konstanten von Neodym im sichtbaren Spektralgebiet und im nahen Ultrarot
Z. Physik 148, 38 (1957)

KH72 L.W. Kry and D. Hemming
Far-infrared absorption in bulk samples of superconducting d-h.c.p. lanthanum
Canadian J. Phys. 50, 2549 (1972)

KN70 Y.V. Knyazev and M.M. Noskov
Optical properties of gadolinium, samarium, and dysprosium in the optical range 1.13-3.96 eV
Phys. Met. Metall. 30, 230 (1970)
Fiz. Met. Metalloved. 30, 214 (1970)

BIBLIOGRAPHY (cont'd)

KN71 Y.V. Knyazev and M.M. Noskov
Optical resonance in ferromagnetic gadolinium
Phys. Met. Metall. 31, 211 (1971)
Fiz. Met. Metalloved. 31, 1099 (1971)

KN72 Y.V. Knyazev and M.M. Noskov
Optical properties of samarium in the infrared range of the spectrum
Phys. Met. Metall. 33, 87 (1972)
Fiz. Met. Metalloved. 33, 546 (1972)

KN73 Y.V. Knyazev and M.M. Noskov
Optical absorption spectra of lanthanum, praseodymium and neodymium
Phys. Met. Metall. 36, 65 (1973)
Fiz. Met. Metalloved. 36, 299 (1973)

KN75 Y.V. Knyazev and M.M. Noskov
Optical properties of terbium in the visible and infrared regions of the spectrum
Opt. Spectrosc. 38, 672 (1975)
Opt. Spektrosk. 38, 1164 (1975)

KN77 Y.V. Knyazev and M.M. Noskov
The optical properties of rare earth metals
Phys. Stat. Sol. B 80, 11 (1977)

KnN71 Y.V. Knyazev and M.M. Noskov
Optical properties of gadolinium in the infra-red range of the spectrum
Phys. Met. Metall. 32, 70 (1971)
Fiz. Met. Metalloved. 32, 1189 (1971)

KnN73 Y.V. Knyazev and M.M. Noskov
Optical properties of dysprosium in the 1-20 μm wave band
Phys. Met. Metall. 35, 26 (1973)
Fiz. Met. Metalloved. 35, 478 (1973)

Kny77 Y.V. Knyazev
Optical properties of thulium in the 0.06-4.9 eV energy range
Opt. Spectrosc. 43, 424 (1977)
Opt. Spektrosk. 43, 718 (1977)

KT75 J. Krizek and K.N.R. Taylor
Optical properties of rare earth films in paramagnetic and magnetically ordered phases
J. Phys. F: Metal Phys. 5, 774 (1975)

Kun66 C. Kunz
Messung charakteristischer Energieverluste von Elektronen an Leichtoxydierbaren Metallen im Ultrahochvakuum
Z. Physik 196, 311 (1966)

BIBLIOGRAPHY (cont'd)

Kun75 C. Kunz
Soft x-ray excitation of core electrons in metals and alloys
Optical Properties of Solids - New Developments
ed. by B.O. Seraphin (North-Holland, Amsterdam, 1975) p. 473

Li72 R.C. Linton
The optical properties of platinum and gold in the vacuum ultraviolet
NASA Technical Note D-7061, October 1972

Liu77 S.H. Liu
Electronic structure of rare earth metals
Handbook on the Physics and Chemistry of the Rare Earths
ed. by K.A. Gschneidner and L. Eyring (North Holland Publishing Co., Amsterdam, 1977) Chapter 3

LM62 R. LaVilla and H. Mendlowitz
Optical constants of aluminum in vacuum ultraviolet
Phys. Rev. Lett. 9, 169 (1971)

LMM71 H.G. Liljenvall, A.G. Mathewson and H.P. Myers
The temperature dependence of the optical constants of aluminium
Solid State Comm. 9, 169 (1971)

LSE64 A.P. Lukirskii, E.P. Savinov, O.A. Ershov, and Yu. F. Shepelev
Reflection coefficients of radiation in the wavelength range from 23.6 to 113 Å for a number of elements and substances and the determination of the refractive index and absorption coefficient
Opt. Spectrosc. 16, 168 (1964)
Opt. Spektrosk. 16, 310 (1964)

LT65 A.P. Lenham and D.M. Treherne
The optical constants of aluminum and indium
Proc. Phys. Soc. 85, 167 (1965)

LT66 A.P. Lenham and D.M. Treherne
Optical constants of single crystals of Mg, Zn, Cd, Al, Ga, In, and white Sn
J. Opt. Soc. Am. 56, 752 (1966)

LTA66 A.P. Lenham and D.M. Treherne
Optical Properties and Electronic Structure of Metals and Alloys
ed. by F. Abelès (North-Holland Publishing Co., Amsterdam, 1966) p. 196

Lyn78 D.W. Lynch
Optical properties of rare earth metals
The Rare Earths in Modern Science and Technology, ed. by G.J. McCarthy and J.J. Rhyne (Plenum Publishing Corporation, New York, 1978) p. 461

BIBLIOGRAPHY (cont'd)

MaM72 A.G. Mathewson and H.P. Myers
Optical absorption in aluminum and the effect of temperature
J. Phys. F: Metal Phys. 2, 403 (1972)

MC61 R.P. Madden and L.R. Canfield
Apparatus for the measurement of vacuum ultraviolet optical properties of freshly evaporated films before exposure to air
J. Opt. Soc. Am. 51, 838 (1961)

MCH63 R.P. Madden, L.R. Canfield, and G. Hass
On the vacuum-ultraviolet reflectance of evaporated aluminum before and during oxidation
J. Opt. Soc. Am. 53, 620 (1963)

MFK67 E. Meyer, H. Frede, and H. Knof
Optical effects in metals: Application of a least-squares method to measurements on gold and silver
J. Appl. Phys. 38, 3682 (1967)

MHS77 T.A. McMath, R.A.D. Hewko, O. Singh, A.E. Curzon, and J.C. Irwin
Optical constants of gold by transmission interferometry
J. Opt. Soc. Am. 67, 630 (1977)

MJT74 R.F. Miller, L.S. Julien, and A.J. Taylor
Optical constants of gadolinium and terbium films obtained from in situ measurements in ultra high vacuum
J. Phys. F: Metal Phys. 4, 2338 (1974)

MM71 A.G. Mathewson and H.P. Myers
Absolute values of the optical constants of some pure metals
Phys. Scripta 4, 291 (1971)

Mot69 G.P. Motulevich
Optical properties of polyvalent non-transition metals
Sov. Phys. Uspekhi. 12, 80 (1969)
Usp. Fiz. Nauk. 97, 211 (1969)

MPF77 N. Ahmed Mokhtar, J.P. Pétraklan, and R. Fraisse
Détermination des paramètres optiques du gadolinium obtenus à parter de mesures des facteurs de réflexion
C.R. Acad. Sc. Paris 285, 159 (1977)

MR76 J.A. MacKay and J.A. Rayne
Temperature dependence of the infrared absorptivity of the noble metals
Phys. Rev. B 13, 673 (1976)

MSB72 C.M. Moscowitz, L.A. Stretz, and R.G. Bautista
The spectral emissivities of lanthanum, cerium, and praseodymium
High Temp. Sci. 4, 372 (1972)

BIBLIOGRAPHY (cont'd)

Mul65 W.E. Müller
Optical properties of divalent rare-earth metals and alkaline-earth metals
Phys. Lett. 17, 82 (1965)

Mul66 W.E. Müller
Optical properties of europium and barium
Solid State Comm. 4, 581 (1966)

Mul67 W.E. Müller
Optische Eigenschaften und Elektronenbandstructur von Europium und Barium
Phys. Kondens. Materie 6, 141 (1976)

Nil Pvt P.O. Nilsson
Private communication

NSW76 J. Naegele, J.C. Spirlet, H. Winkelman
Optical reflectivity of americium metal
Presented at the 2nd VUV Conference on the Electronic Structure of the Actinides, Warsaw, Poland (1976)

OBr36 H.M. O'Bryan
The optical constants of several metals in vacuum
J. Opt. Soc. Am. 26, 122 (1936)

OL81 C.G. Olson and D.W. Lynch
Rare earth 4d absorption spectra in rare earth trifluorides
J. Opt. Soc. Am. (in press)

OTM80 J. Onsgaard, S. Tougaard, P. Morgan, and F. Ryborg
Scandium and lutetium surfaces studied by reflection electron energy-loss spectroscopy
J. Electron Spect. and Related Phenomena 18, 29 (1980)

Ott61 M. Otter
Optische Konstanten massiver Metalle
Z. Physik 161, 163 (1961)

PD78 J.P. Pétrakian and G. Derbez
Optical properties of europium thin films
Thin Solid Films 51, 155 (1978)

Pet69 J.P. Pétrakian
Étude des propriétés optiques de couches minces d'yttrium sous ultra-vide statique
C.R. Acad. Sc. Paris 269, 434 (1969)

BIBLIOGRAPHY (cont'd)

Pet70 J.P. Pétrakian
Sur une phénomène d'absorption anormale se produisant dans des couches minces de terbium
C.R. Acad. Sc. Paris B270, 624 (1970)

Pet72 J.P. Pétrakian
Direct transitions at optical frequencies in rare-earth metals
J. Opt. Soc. Am. 62, 401 (1972)

Petr72 J.P. Pétrakian
New investigation of the optical absorption of rare-earth thin films
Thin Solid Films 13, 269 (1972)

Pet74 J.P. Pétrakian
Conductivité et transitions optiques dans des couches minces d'ytterbium
Thin Solid Films 20, 297 (1974)

Pet76 J.P. Pétrakian
Optical conductivity of rare earth thin films in relation to their crystalline structure and electronic configuration
Thin Solid Films 38, 83 (1976)

PMF77 J.P. Pétrakian, N. Ahmed Mokhtar, and R. Fraisse
Optical constants of gadolinium at various temperatures from polarimetric measurements
J. Phys. F: Metal Phys. 1, 2431 (1977)

PP69 J.P. Pétrakian and J.P. Palmari
Réalisation d'une enceinte pour l'étude de couches minces metalliques sous ultra-vide statique
Thin Solid Films 4, 423 (1969)

PPR70 J.P. Pétrakian, J.P. Palmari, and G. Rasigni
Les propriétés optiques de couches minces d'yttrium sous ultravide statique
Appl. Optics 9, 2115 (1970)

PS69 G.P. Pells and M. Shiga
The optical properties of copper and gold as a function of temperature
J. Phys. C: Solid State Phys. 2, 1835 (1969)

QLJ81 A. Quemarais, B. Loisel, G. Jezequel, J. Thomas, and J.C. Lemonnier
Optical spectra of gadolinium and dysprosium: Study of the 5p thresholds
J. Phys. F 11, 293 (1981) and B. Loisel, private communication.

BIBLIOGRAPHY (cont'd)

Ro66 S. Robin
Propriétés optiques de l'argent et du palladium dans l'ultraviolet lointain
Optical Properties and Electronic Structure of Metals and Alloys
ed. by F. Abelès (North Holland Publishing Co., Amsterdam, 1966)
p. 202

RT75 J. Rivory and M.L. Theye
Optical properties of Ag-Cu alloys: Evidence for d-virtual bound states on Cu impurities
J. Physique 36, L129 (1975)

RYE77 K.G. Ramanathan, S.H. Yen, and E.A. Estalote
Total hemispherical emissivities of copper, aluminum, and silver
Appl. Optics 16, 2810 (1977)

Sa39 G.B. Sabine
Reflectivities of evaporated metal films in the near and far ultraviolet
Phys. Rev. 55, 1064 (1939)

SB64 J.E. Shaw and W.R. Blevin
Instrument for the absolute measurement of direct spectral reflectances at normal incidence
J. Opt. Soc. Am. 54, 334 (1964)

Sc54 L.G. Schulz
An experimental confirmation of the Drude free electron theory of the optical properties of metals for silver, gold, and copper in the near infrared
J. Opt. Soc. Am. 44, 540 (1954)

Sch54 L.G. Schulz
The optical constants of silver, gold, copper, and aluminum
I. The absorption coefficient k
J. Opt. Soc. Am. 44, 357 (1954)

Sch57 L.G. Schulz
The experimental study of the optical properties of metals and the relation of the results to the Drude free electron theory
Adv. Phys. 6, 102 (1957)

Sch66 C. Chr. Schüler
Recent studies on the optical properties of rare earth metals
Optical Properties and Electronic Structure of Metals and Alloys
ed. by F. Abelès (North Holland Publishing Co., Amsterdam, 1966)
p. 221

BIBLIOGRAPHY (cont'd)

Sch72 M. Schlüter
Die Optischen Eigenschaften von Gold, Silber und Gold-Silber-Legierungen zwischen 2 und 40 eV aus Energieverlustmessungen
Z. Physik 250, 87 (1972)

Sco67 W.J. Scouler
Temperature-modulated reflectance of gold from 2 to 10 eV
Phys. Rev. Lett. 18, 445 (1967)

SeS70 D.H. Selb and W.E. Spicer
Photoemission and optical studies of Cu-Ni alloys. I. Cu-rich Alloys
Phys. Rev. B 2, 1676 (1970)

SG64 W.T. Spencer and M.P. Givens
Ultrahigh-vacuum measurement of the optical properties of copper
J. Opt. Soc. Am. 54, 1337 (1964)

SIS75 S. Suzuki, T. Ishii, and T. Sagawa
4d-shell photoabsorption spectra of lanthanum - and cerium - halides
J. Phys. Soc. Japan 38, 156 (1975)

SJ79 M.L. Scott and G.T. Johnston
Calorimetric measurement of absorption vs. temperature in a gold film
Appl. Optics 18, 2905 (1979)

Sm77 T. Smith
Optical constants of copper and nickel
J. Opt. Soc. Am. 67, 48 (1977)

SN72 I.I. Sasovskaya and M.M. Noskov
Optical properties of copper-nickel alloys in the visible and ultraviolet regions of the spectrum
Sov. Phys. Solid State 14, 857 (1972)
Fiz. Tverd. Tela. 14, 999 (1972)

SS80 E. Shiles, T. Sasaki, M. Inokuti, and D.Y. Smith
Self-consistency and sum-rules tests in the Kramers-Kronig analysis of optical data: Application to aluminum
Phys. Rev. B 22, 1612 (1980)

ST54 L.G. Schulz and F.R. Tangherlini
Optical constants of silver, gold, copper, and aluminum.
II. The index of refraction n
J. Opt. Soc. Am. 44, 362 (1954)

TC73 P. Trebbia and C. Colliex
Study of the excitation of 4d electrons in rare earth metals by inelastic scattering of a high energy electron beam
Phys. Stat. Sol. B 58, 523 (1973)

BIBLIOGRAPHY (cont'd)

TH70 M.L. Thèye
Investigation of the optical properties of Au by means of thin semitransparent films
Phys. Rev. B 2, 3060 (1970)

Th Pvt M.L. Thèye
Private communication

TP51 D.H. Tomboulian and E.M. Pell
Absorption by aluminum in the soft x-ray region
Phys. Rev. 83, 1196 (1951)

Tra77 D.H. Tracy
Photoabsorption structure in lanthanides: 5p subshell spectra of Sm I, Eu I, Dy I, Ho I, Er I, Tm I, and Yb I
Proc. R. Soc. London A 357, 485 (1977)

TRZ72 E.V. Tsveiman, V.S. Red'kin, V.V. Zashkvara, and M.I. Korsunskii
Spectra of characteristic electron-energy losses in gadolinium and dysprosium
Sov. Phys. Solid State 13, 2339 (1972)
Fiz. Tverd. Tela 13, 2793 (1971)

VKF73 B.W. Veal, D.D. Koelling, and A.J. Freeman
Observation of itinerant 5f states in thorium metal
Phys. Rev. Lett. 30, 1061 (1973)

WBR76 H.W. Wolff, R. Bruhn, K. Radler, and B. Sonntag
Atomic character of the 4d absorption of Ce metal: An experimental proof
Phys. Lett. 59A, 67 (1976)

Wea80 J.H. Weaver
Low energy optical absorption in α-U metal
J. Opt. Soc. Am. 70, 1030 (1980)

WeG74 C. Wehenkel and B. Gauthé
Optical absorption coefficient of nickel, palladium, platinum, copper, silver, gold between 20 and 120 eV
Optics Comm. 11, 62 (1974)

We077 J.H. Weaver and C.G. Olson
Optical examination of the electronic structure of single-crystal hcp scandium
Phys. Rev. B 16, 731 (1977)

We0177 J.H. Weaver and C.G. Olson
Interband structure and the role of the 5f electronic states of thorium: An optical investigation
Phys. Rev. B 15, 4602 (1977)

BIBLIOGRAPHY (cont'd)

We Unpub J.H. Weaver
Unpublished

Wes63 P.R. Wessel
Reflectivity of silver-gold alloys in the spectral region 1.8-5.0 eV
Phys. Rev. 132, 2062 (1963)

WG74 C. Wehenkel and B. Gauthé
Optical constants of metals in the vacuum UV spectral region determined by energy loss analysis of fast electrons scattered around the forward direction
Proceedings of the VI International Conference on Vacuum Ultraviolet Physics, Hamburg, ed. by E.E. Koch, R. Haensel, and C. Kunz (Pergamon Vieweg, 1974) p. 455

WKL76 P. Winsemius, F.F. van Kampen, H.P. Lengkeek, and C.G. van Went
Temperature dependence of the optical properties of Au, Ag, and Cu
J. Phys. F: Metal Phys. 6, 1583 (1976)

WL73 J.H. Weaver and D.W. Lynch
Absorptivity of single-crystal yttrium at 4.2 K
Phys. Rev. B 7, 4737 (1973)

WL75 J.H. Weaver and D.W. Lynch
Anistropic optical properties of heavy-rare-earth single crystals
Phys. Rev. Lett. 34, 1324 (1975)

WO76 J.H. Weaver and C.G. Olson
Optical absorption in the 4d transition metals from 20 to 250 eV
Phys. Rev. B 14, 3251 (1976)

WO77 J.H. Weaver and C.G. Olson
Optical absorption of hcp yttrium
Phys. Rev. B 15, 590 (1977)

WO177 J.H. Weaver and C.G. Olson
Soft x-ray absorption studies of thorium 5d-5f structures in thorium and thorium compounds
Proc. V Int. Conf. Vac. Ultraviolet Rad. Phys., Montpellier, France (1977)

YS65 R.G. Yarovaya and I.N. Shklyarevskii
Investigation of quantum absorption in silver
Opt. Spectrosc. 18, 465 (1965)
Opt. Spektrosk. 18, 832 (1964)

ZFG67 T.M. Zimkina, V.A. Fomichev, S.A. Gribovskii, and T.I. Zhukova
Anomalies in the character of the x-ray absorption of rare earth elements of the lanthanide group
Sov. Phys. Solid State 9, 1128 (1967)
Fiz. Tverd. Tela. 9, 1447 (1967)

BIBLIOGRAPHY (cont'd)

ZTK72 V.V. Zashkvara, E.V. Tsvelman, M.I. Korsunskii, and V.S. Red'kin
Characteristic energy loss spectra of electrons reflected from La, Ce, Pr, and Nd surfaces
Sov. Phys. Solid State 14, 1564 (1972)
Fiz. Tverd. Tela. 14, 1812 (1972)