

substance: EuTe

property: crystal structure, physical properties

crystal structure cubic ($O_h^5 - Fm3m$)

lattice parameters

a	6.597 Å		69L
	6.5984(1) Å	$T = 298.15$ K	74M

melting point

T_m	2456(2) K	72R
-------	-----------	-----

density

d	6.461 g cm ⁻³	74M
-----	--------------------------	-----

energy gap

$E_g(4f - 5d)$	2.0 eV		optical spectroscopy	71G
	2.062(5) eV	$T = 1.7$ K	optical spectroscopy	78S
	1.33 eV		optical spectroscopy	72S2
dE_g/dp	- 12.0 meV kbar ⁻¹		opt. absorption	69W

bulk modulus

B_0	400(30) kbar		70L
	357(50) kbar	$T = 77.6$ K	72S3
	400(50) kbar		74J

linear thermal expansion coefficient

α	13.6·10 ⁻⁶ K ⁻¹	69L
----------	---------------------------------------	-----

elastic moduli

c_{11}	9.36(40)·10 ¹⁰ Pa	$T = 77.6$ K	72S1, 72S3
c_{12}	0.67(60)·10 ¹⁰ Pa	$T = 77.6$ K	
c_{44}	1.63(7)·10 ¹⁰ Pa	$T = 77.6$ K	

compressibility

κ	2.5·10 ⁻¹¹ Pa ⁻¹	70L
----------	--	-----

sound velocity

$v_{[100]}$	3.78·10 ⁵ cm s ⁻¹	$T = 77.6$ K	72S3
$v_{[110]}$	3.19·10 ⁵ cm s ⁻¹	$T = 77.6$ K	

Debye temperature

Θ_D	140 K	64B
	189 K	72S3

heat capacity

C_p	52.17 J mol ⁻¹ K ⁻¹	heat capacity near the magnetic phase transition [80J]	74M
-------	---	--	-----

phonon wavenumbers

$(\nu/c)_{\text{TO}}$	102.3(20) cm^{-1}			73H
	111.7 cm^{-1}	$T = 2\text{K}$		73I
$(\nu/c)_{\text{LO}}$	141.5(20) cm^{-1}			73H
	113 cm^{-1}	$T = 2\text{K}$		79G, 83O
	111 cm^{-1}	$T = 0\text{K}$	theoretical value	83O

dielectric constants

$\varepsilon(0)$	6.9			74G
	8.23			73H
$\varepsilon(\infty)$	5.75			74G
	5.92			68W
	4.18			73H

refractive index

n	2.71	at 4f – 5d absorption edge		71G
-----	------	----------------------------	--	-----

f-d transition energy

$E(4f - 5d)$	2.0 eV	edge		71G
	2.062(5) eV	edge, $T = 1.7\text{K}$		78S
$E(4f - 5d)$	2.64 eV	maximum		75S

absorption coefficient

K	$1.82 \cdot 10^5 \text{ cm}^{-1}$	max. 4f- – 5d trans.		75S
-----	-----------------------------------	----------------------	--	-----

oscillator strength

f	0.25	oscillator strength of 4f – 5d transition		71G
-----	------	---	--	-----

f-d transition width

$W(4f - 5d)$	0.6 eV	width of 4f – 5d transition		71G
--------------	--------	-----------------------------	--	-----

photothreshold

E_{thr}	4.6(1) eV	ionization energy (photothreshold)		76M
------------------	-----------	------------------------------------	--	-----

work function

ϕ	3.6(3) eV	work function		76M
--------	-----------	---------------	--	-----

electrical conductivity

σ	$10^{-8} \Omega^{-1} \text{ cm}^{-1}$	high resistivity sample		71G
	$40 \dots 250 \Omega^{-1} \text{ cm}^{-1}$			72S2
	$0.13 \dots 4 \Omega^{-1} \text{ cm}^{-1}$	$T = 4\text{K}$		

electron mobility

μ_n	$33 \dots 58 \text{ cm}^2/\text{V s}$			72S2
---------	---------------------------------------	--	--	------

electron concentration

n 0.5...1.3·10¹⁹ cm⁻³ 72S2

activation energy for conductivity

E_A 33 meV 75V

Figures and further references:

density of states: Fig. 1 and [82L]

IR measurements [73H, 73I]

Raman spectra [79G]; calculated Raman spectra [83O]

real and imaginary parts of the **dielectric constant:** Figs.2, 4

absorption spectrum: Fig. 3

absorption edge: Fig. 5, shift of absorption edge [82M]

electronic excitation spectrum [82L]

photosensitivity: Fig. 6

electron-phonon interaction [81U]

References:

- 64B Busch, G., Junod, P., Morris, R. G., Muheim, J., Stutius, W.: Phys. Lett. 11 (1964) 9.
68W Wachter, P.: Phys. Kondens. Mater. 8 (1968) 80.
69L Levy, F.: Phys. Kondens. Mater. 10 (1969) 71.
69W Wachter, P.: Solid State Commun. 7 (1969) 693.
70L Levy, F., Wachter, P.: Solid State Commun. 8 (1970) 183.
71G Günterodt, G., Wachter, B., Imboden, D. M.: Phys. Kondens. Mater. 12 (1971) 292.
72R Reed, T. B., Fahly, R. E., Strauss, A. J.: J. Cryst. Growth 15 (1972) 174.
72S1 Shapira, Y., Reed, T. B.: AIP Conf. Proc. 5 (1972) 837.
72S2 Sadovskaya, O. A., Stepanov, E. P., Khrapov, V. V., Yarembash, E. I.: Inorg. Mater. (USSR) 8 (1972) 708.
72S3 Shapira, Y., Reed, T. B.: Phys. Rev. B 5 (1972) 2657.
72W Wachter, P.: CRC Crit. Rev. Solid State Sci. 3/12 (1972) 189.
73H Holab, G. D., Webb, J. S., Dennis, R. B., Pidgeon, C. R.: Solid State Commun. 13 (1973) 209.
73I Ikezawa, H., Suzuki, T.: J. Phys. Soc. Jpn. 35 (1973) 1556.
74G Günterodt, G.: Phys. Condens. Matter 18 (1974) 37.
74J Jayaraman, A., Singh, A. K., Chatterjee, A., Usha Devi, S.: Phys. Rev. B 9 (1974) 2513.
74M Mc Masters, O. D., Gschneidner, K. A., Kaldis, E., Sampietro, G.U.: J. Chem. Thermodyn. 6 (1974) 845.
75S Schoenes, J.: Z. Phys. B 20 (1975) 345.
75V Vitins, J., Wachter, P.: Phys. Rev. B 12 (1975) 3829.
76M Munz, P.: Helv. Phys. Acta 49 (1976) 281.
78S Schmutz, L. E., Dresselhaus, G., Dresselhaus, M. S.: Solid State Commun. 28 (1978) 597.
79G Güntherodt, G.: J. Magn. Magn. Mater. 11 (1979) 394.
79W Wachter, P.: Handbook on the Physics and Chemistry of Rare Earths, Vol. 11, Gschneidner, K. A. and Eyring, L. R. (eds.), Amsterdam: North-Holland, 1979.
80J Johanson, W. R., McCollum, D. C.: Phys. Rev. B 22 (1980) 2435.
81U Umehara, M.: J. Phys. Soc. Jpn. 50 (1981) 1082.
82L v. d. Linden, W., Nolting, W.: Z. Phys. B Condens. Matter 48 (1982) 191.
82M Matlak, M., Ramakanth, A., Skrobis, K.: Z. Phys. B Condens. Matter 48 (1982) 227.
83O Ousaka, Y., Sakai, O., Tachiki, M.: J. Phys. Soc. Jpn. 52 (1983) 1034.

Fig. 1.

Eu-chalcogenides. Schematic density of states [79W].

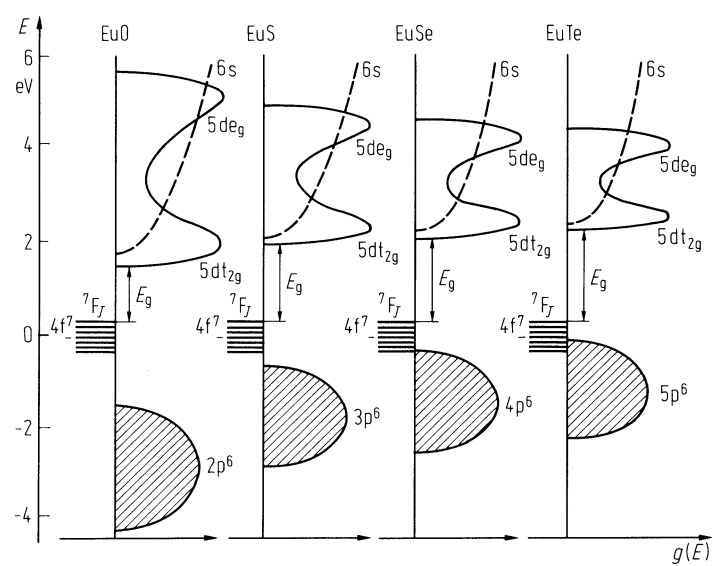


Fig. 2.

Eu-chalcogenides. Real part of the dielectric constant vs. photon energy at 300 K [74G].

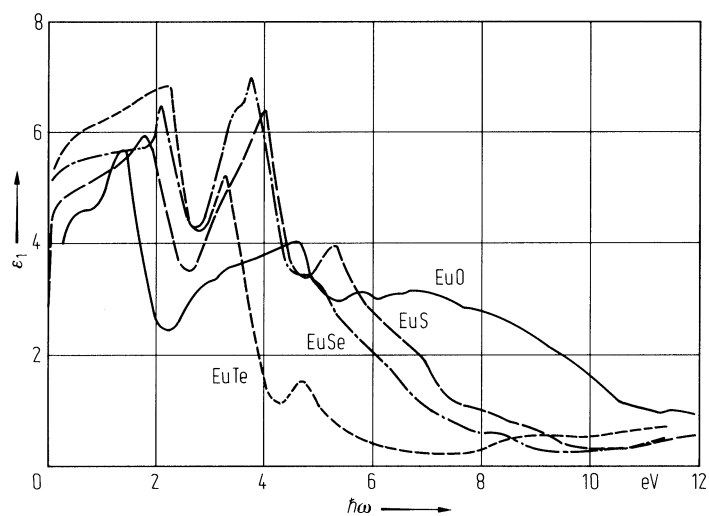


Fig. 3.

Eu-chalcogenides. Absorption coefficient vs. photon energy at 300 K, from reflectivity measurements [74G].

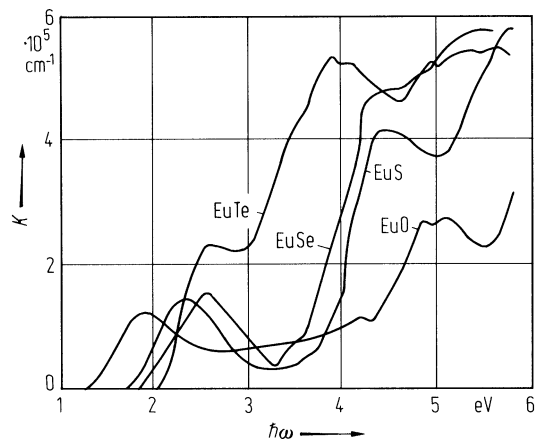


Fig. 4.

Eu-chalcogenides. Imaginary part of the dielectric constant vs. photon energy at 300 K [74G].

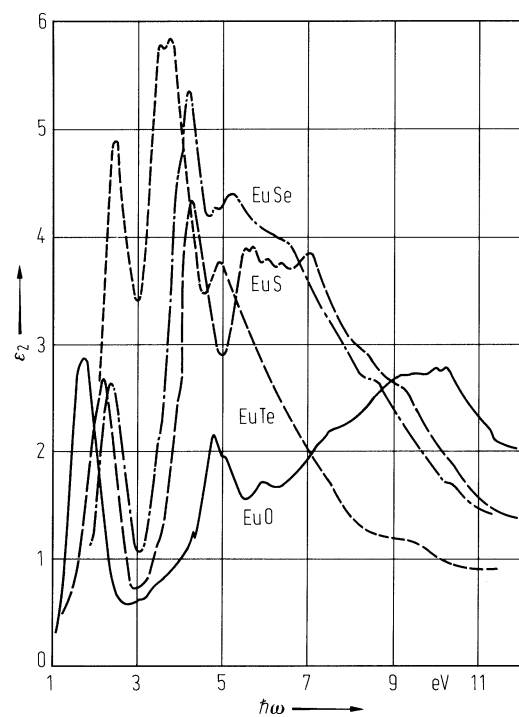


Fig. 5.

EuTe. Absorption coefficient vs. photon energy near the absorption edge at $T = 1.7$ K and $B = 8.34$ T with $E \parallel B$ [78S].

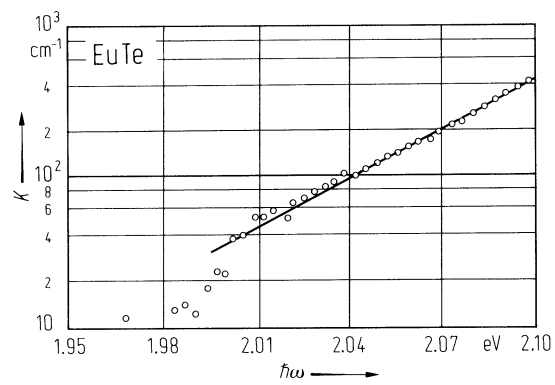


Fig. 6.

Eu-chalcogenides. Photosensitivity (photo current / light intensity) vs. temperature. The exciting wavelength is kept at the maximum of the photo-response [72W].

