physica status solidi b basic solid state physics
1970, Volume 42, Number 1, pag. K85-K87

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https://doi.org/10.1002/pssb.19700420167

phys. stat. sol. 42, K85 (1970)
Subject classification: 20.1; 13.1; 22.7

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Reflectivity Spectra of the Orthorhombic Crystal Bi_2S_3

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The materials of $A^V_2 B^{VI}_3$ group have been extensively used long ago in the semiconducting electronics (1). The electronic spectra of all this group compounds aside from Bi_2S_3 have been investigated in a wide energy region (see, for example (2 to 4)).

The present communication is devoted to the investigation of the electronic spectra of Bi_2S_3 single crystals in the range of 1 to 12.5 eV.

The compound Bi_2S_3 has been obtained from the elements in quartz ampoules evacuated (10^{-4} Torr) and filled by specpure argon (5). The single crystals examined have been obtained in a vertical furnace by the Bridgeman method with a temperature gradient of 80 deg/cm. The samples were 7 mm in diameter and 15 mm long.

The reflection spectra of cleaved Bi_2S_3 monocrystals have been investigated in the range 1 to 5 eV at 77 and 293 °K for polarizations $\mathcal{E} \parallel \mathcal{L}$ and $\mathcal{E} \parallel \alpha$ and in the range 5 to 12.5 eV at 293 °K with unpolarized light by the method described in (2, 3).

At 77 °K there are two intensive maxima at 2.4 and 3.1 eV and three weak bands at nearly 1.8, 4, and 4.7 eV for the polarization $\mathcal{E} \parallel \mathcal{L}$ but for the other polarization ($\mathcal{E} \parallel \alpha$) there are intensive maxima at 3.05 eV and weak bands at 1.65, 1.9, 2.1, 2.3, and 4 eV. The bands at 2.4 and 4.7 eV are readily seen to be highly polarized. The complex reflection structure is broadened and less clearly pronounced by rising the temperature to 293 °K.

In the vacuum ultraviolet range there are three bands at 6, 9.9, and 11.3 eV and a very weak band around 7 eV for unpolarized light at 293 °K (Fig. 1).

The related orthorhombic crystals Bi_2S_3, Sb_2Se_3, and Sb_2S_3 (3) are isomorphic with the space group D^{16}_{2h} (1). The energy spectra and dipole selection rules were studied by group-theoretical methods (6). But other quantitative calculations of the