SPECIMEN P REPRATION AND SOME OPTICAL P OPERTIES OF SnS_2

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Tin disulfide is a layered semiconductor which crystallizes in a hexagonal lattice (1) with a CdI_2 structure. The electronic charge densities of SnS_2 (2,3), energy band structure (4,5,6,7), optical energy gap (8,9), photoemission (4,5), photoconductivity (8) and some other optical properties have been studied in recent years.

In this work a method of obtaining bulk SnS_2 single crystals and some of their optical properties are described.

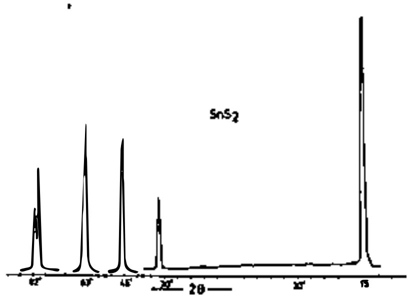

Figure 1.

Single crystal bulk samples of SnS_2 were made using the Bridgemann technique. The speed of lowering the quartz ampoule was about 2 mm/h using a furnace of suitable profile. It was not possible to make a large single crystal but some twins were prepared with high quality surfaces of about 100 mm^2 each. These crystals were soft and layered. Thin samples for transmission measurements were prepared using a cleavage procedure. These plates were oriented {001} which was confirmed by X-ray analysis. The diffractogram is given in Figure 1. The transmission of monochromatic light in the rang of the absorption edge measured with rather thin samples ($d \approx 20\,\mu m$). Using those experimental data an indirect forbidden optical energy gap of E_g= 2,08 eV was obtained by plotting the third root the absorption coefficient ($\alpha^{1/3}$) versus the wavelegth (Figure 2.). This value is in reasmable agrement with the literature data (4,8,9).

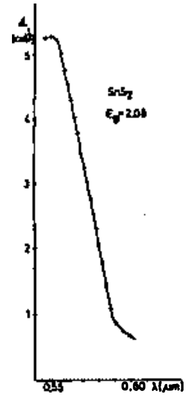

Figure 2.

Some preliminary transmission measurments of monochromatic light at the temperature of 77 K have been done. Using these measurements it was noticed that the energy gap increased rather fast with decrease in temperature so that temperature coefficient of the energy gap was $\frac{dE_g}{dT} \approx -6\cdot10^{-4}$ eV/K. Well exposed interference fringes were observed using very homogenous thin SnS_2 sample (d≈10 μm) for the transmission measurements in a wide range between 0,55 μm and 40 μm. These data are presented in Figure 3. for a narrower range. The index of refraction has been calculated as a function of the wavelength (Figure 4.) for a wider rang than has been done in the literature (8), using the observed interference fringes given in Figure 3. Some preliminary experimental work concerning the lattice vibration of SnS_2 has been also done. A typical reflectivity diagram in

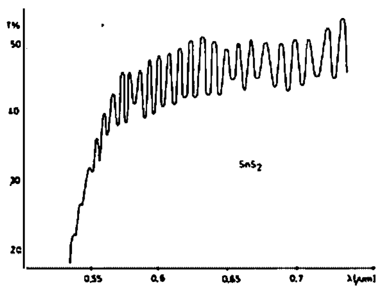

Figure 3.

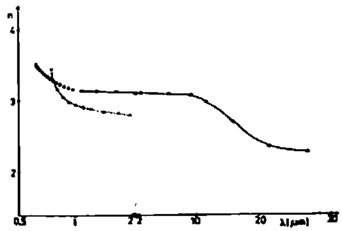

Figure 4.

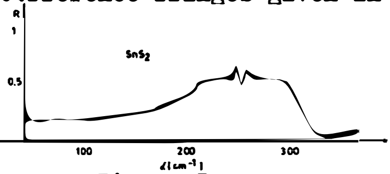

Figure 5.

the far infra red rang for SnS_2 is shown in Figure 5., where it is obvious that at least one "Reststrahlen" band exists at the wavelength of about 45 μm.

References

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