OPTICAL PROPERTIES OF GeO₂ IN THE ULTRAVIOLET REGION

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The optical constants of amorphous and crystalline GeO₂ were determined by measurements of reflectivity in the region of phonon energy 0.5—25 eV and subsequent use of Kramers—Kronig analysis. The differences between the spectra of GeO₂ and those of SiO₂ are shown and discussed.

1. INTRODUCTION

The absorption edge of hexagonal and glassy GeO₂ was investigated by H. E. Papazian [1] and A. J. Cohen [2] respectively. The reported energies of absorption edges are 5.56 eV for the hexagonal and 5.63 eV for the glassy material.

R. P. Madden [3] measured the reflectivity of GeO₂ in the far UV region as a function of the angle of incidence at wavelengths of 1216Å, 735Å and 584Å and determined the optical constants n and k at these wavelengths. In these experiments the samples were prepared by heating evaporated Ge layers in air at 400 °C and were found to be soluble in water. Unfortunately, no evidence on the crystalline structure of samples was reported.

In the present paper the normal reflectivity of amorphous and crystalline GeO₂ is investigated in the range of photon energy from 0.5 eV to 25 eV; the optical constants are determined using the Kramers-Kronig dispersion relation.

2. EXPERIMENTAL DETAILS

The high quality material in the glassy modification was prepared in our laboratory by Dr. Z. Troušil. The procedure included melting of powdered hexagonal GeO₂ in a platinum crucible in vacuum and subsequent cooling in oxygen atmosphere.

![Fig. 1. Index of refraction of glassy GeO₂.](image-url)

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Fig. 2. Reflectivity of crystalline and glassy GeO$_2$ as a function of photon energy.

Fig. 3. Reflectivity of crystalline GeO$_2$ (curve 1), reflectivity of an oxidized thin layer of Ge (curve 2) and reflectivity of the layer prepared by condensation of GeO$_2$ vapour (curve 3). The points marked by triangles are taken from [3].