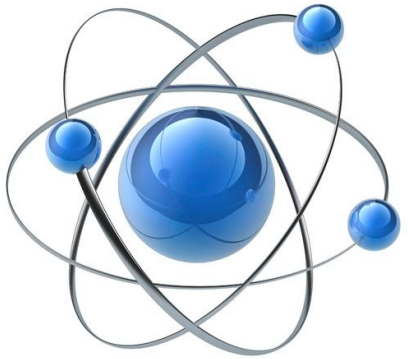
SUAI State University of Aerospace Instrumentation



The study of variations in refractive indices of ZnSe single crystals in the range of 1.5-27 microns

E N Kotlikov, Yu A Novikova and G V Tereshchenko

Introduction

The study of using new materials for the production of optical sensors, synthetic vision systems, and modern glasses with specified frequency polarization properties is impossible without their experimental research. Such research is focused on the further solution for the problems of synthesis or optimization of the technological process using accurate data on the parameters of a specific sample of production optical material. Here are the results of measurements and algorithms for processing the data obtained in order to estimate the refractive index of zinc selenide single crystals of the same ZnSe CVD type from different batches. A method for determining the refractive index is developed based on the spectrophotometric method using the reflection and transmittance spectra of plates, as well as the spectrum of the reflection from the sample surface. The results of the study showed not only the correctness of the proposed method. They also showed that in the studied part of the infrared range, the obtained refractive indices for different samples of zinc selenide from the same batch differ more from each other than indicated in reference publications. It should be taken into account when developing products of transmittance optics

Results of study

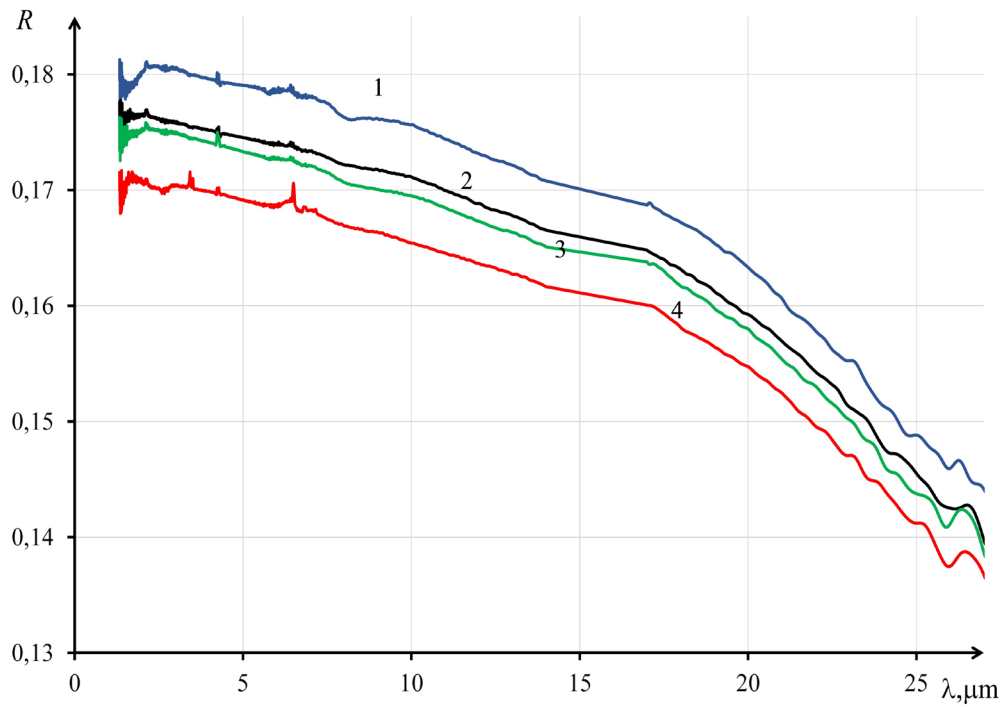


Figure 1. 1,2,3,4 - R_S reflection spectra from the surfaces of four samples of zinc selenide

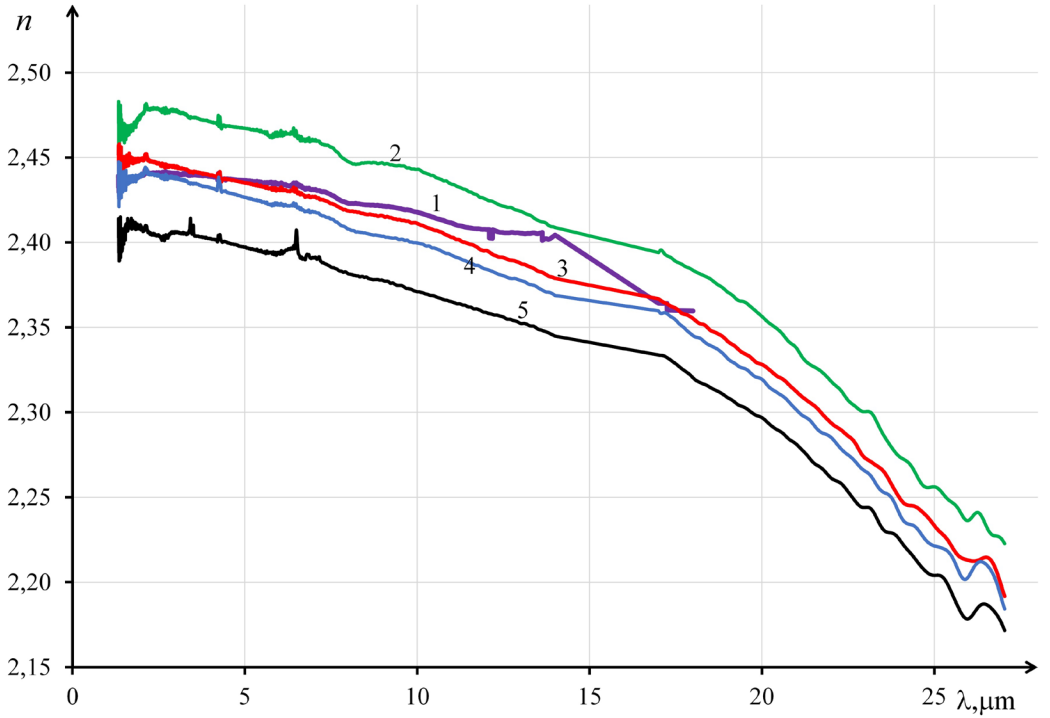


Figure 2. Dispersion of the ZnSe refractive index (1 - according to the RT spectrum of the plate, 2-5 according to the R spectra from the surface)

Results of study. Conclusion

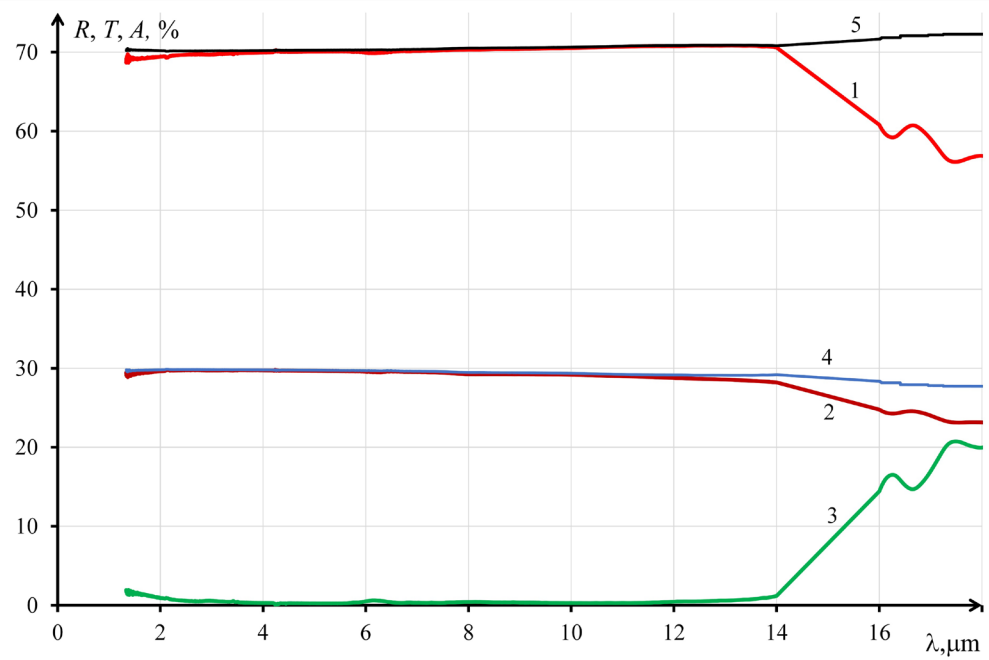


Figure 3. ZnSe plate spectra (1 - experimental transmittance spectrum, 2 - experimental reflection spectrum, 3 - experimental absorption spectrum, 4 - corrected reflection spectrum, 5 - corrected transmittance spectrum)

We developed and experimentally confirmed a spectrophotometric method for determining the refractive index of materials using the reflection and transmittance spectra of plates, as well as the reflection spectrum from the sample surface. The developed method was confirmed experimentally and used to find the refractive index of ZnSe in the range of 1.5-27 microns for different samples of material from the same batch.

The correctness of the proposed method also confirms that the results obtained for the average refractive index of zinc selenide are in good compliance with the data of other authors [10-15]. It should be noted that the reference literature provides the value of the refractive index with an accuracy of 0.001, while the variations of the refractive index in the studied part of the infrared range for different samples reach 0.04, which should be taken into account when developing products of transmittance optics.