Influence of Impurities Gd and Yb on the IR Transmission of the Crystal ZnSe<Te>

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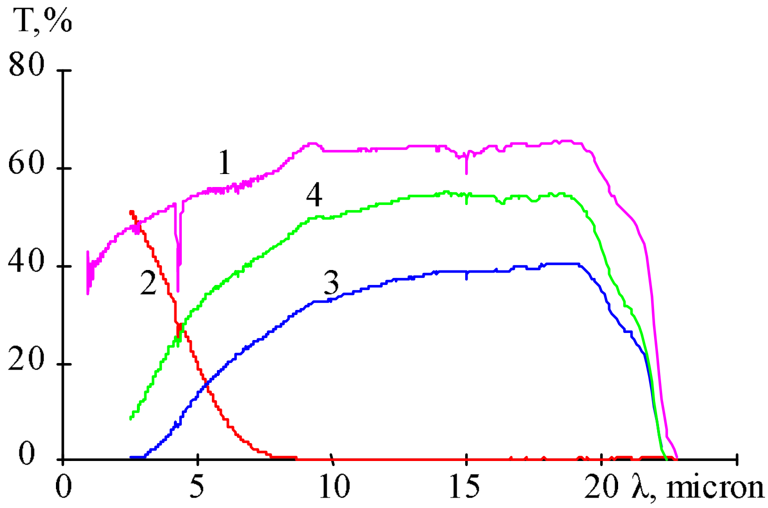
Due to the rapid development of infrared laser technology in recent years is a very urgent problem of the choice of highly transparent material for the manufacture of optical elements – windows, lenses, prisms, mirrors, beam splitters, etc. Successful promptness of optical, mechanical and thermal properties of zinc selenide led to its widespread use in the power of IR-optics. However, note that the good (50-60%) transmission in the spectral range of 5-20 microns has only a high-purity material. That fact is illustrated by curve 1 for monocrystal ZnSe, grown from the melt of stoichiometric composition under pressure of an inert gas. The main drawback of such designs is the poor resistance to high-power laser radiation, which can be increased nearly 5 orders of magnitude by doping during the growth of crystals in an isovalent impurity Te [1]. However, studies have shown that samples of ZnSe<Te> are almost opaque to radiation with a wavelength of $\lambda \geq 7$ microns, curve 2. This makes it impossible to use this material as an element of the optical systems, which contain the CO_2-laser ($\lambda_m \approx 10{,}6$ microns). We have found a significant decrease in absorption crystal ZnSe<Te> at $\lambda \geq 3$ microns with a result of doping with rare earth elements from the vapor phase. Transmittance at 10,6 microns reaches 30% and 50% for samples doped with Gd and Yb, as can be seen from the figure curves 3 and 4, respectively. Possible mechanisms responsible for the formation of IR transmittance are discussed.



1. Ryzhikov V.D. Scintillation crystals of semiconductor compounds $A^{II}B^{VI}$. Preparation, properties and application. M.: NIITEKHIM, 1989, 123 p.