Temperature-Dependent Photoconductivity Response and Band Gap Variation of Tl₂In₂S₃Se Layered Single Crystals

IPEK GLER, ankaya University, NIZAMI GASANLY, Middle East Technical University, MARIANNA AMBRICO, CNR-Istituto di Metodologie Inorganiche e dei Plasmi-UOS di Bari,, TERESA LIGONZO, Bari University — Temperature variation of indirect band gap of Tl₂In₂S₃Se layered single crystals were obtained by means of absorption and photoconductivity measurements. The temperature coefficient of $-7.1 \times 10^{-4}$ eV/K from absorption measurements in the temperature range of 10–300 K in the wavelength range of 520–1100 nm and $-5.0 \times 10^{-4}$ eV/K from PC measurements in the temperature range of 132–291 K in the wavelength range of 443–620 nm upon supplying voltage $V = 80$ V were obtained. From the analysis of dark conductivity measurements in the temperature range of 150–300 K, conductivity activation energy was obtained as $0.51$ eV above 242 K. The degree of the disorder, the density of localized states near Fermi level, the average hopping distance and average hopping energy of Tl₂In₂S₃Se crystals were found as, $1.9 \times 10^5$ K, $N_f = 4 \times 10^{20}$ cm$^{-3}$eV$^{-1}$, 29.1 Å and 24.2 meV in the temperature range of 171–237 K, respectively. Activation energy of hopping conductivity at $T = 171$ K was obtained as 41.3 meV and the concentration of trapping states was found as $1.6 \times 10^{19}$ cm$^{-3}$. 

Ipek Gler
ankaya University

Date submitted: 13 Nov 2016

Electronic form version 1.4