

MATERIALS RESEARCH EXPRESS

VOLUME 6, NUMBER 12

18 DECEMBER 2019

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DOI: [10.1088/2053-1591/ab5f8a](https://doi.org/10.1088/2053-1591/ab5f8a)

Birefringence of SnSe single crystals in excitonic and electronic transitions region

Abstract

Absorption spectra in temperature range 300–10 K were studied. The minimal band gap A_1 (1.091 eV at 300 K) is formed by direct allowed in $E \parallel c$ polarization and forbidden in $E \parallel a$ polarizations transitions. The next interval B_1 (1.316 eV) is formed by direct transitions allowed in $E \parallel a$ polarization and forbidden in $E \parallel c$ polarization. Angular dependences of the electron transitions in the band gap minimum were investigated. Spectral dependences of refractive index (n) were calculated from wavelength modulation transmission ($\Delta T/\Delta\lambda$) and reflection ($\Delta R/\Delta\lambda$) spectra in the region of direct electron transitions. The absorption edge shifts to higher energies with temperature decreasing, and temperature coefficient of edge absorption shift (β) is $3.4 \times 10^{-3} \text{ eV K}^{-1}$.