Turkish Journal of Physics

Turkish Journal

of

Physics

Urbach-Martienssen's tail in layered ternary semiconductor $TlGaS_2$

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Keywords
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Abstract: Dependence of the absorption coefficient on the photon energy and temperature near the fundamental absorption edge was measured for layered single crystal $TlGaS_2$. The exponentially increasing absorption tail was explained as an Urbach-Martienssen's (U-M's) tail for $TlGaS_2$ samples in the 10-340 K temperature range. The characteristic Urbach's parameters such as steepness parameter [σ (T)] and Urbach's energy [($E_u = k_B T / \sigma$)] were determined. Analyzing the temperature dependence of these parameters based on the general models, which takes into account the possible role of several different types of disorder, we conclude that the absorption process in the fundamental absorption edge for $TlGaS_2$ is the result of the superposition of at least two different mechanisms; one is related to the phonon induced microfields and the other results from structural and thermal disorders.

Key Words: Optical characterization; Urbach rule; layered semiconductors; $TlGaS_2$.

Turk. J. Phys., **25**, (2001), 543-550.
Full text: pdf
Other articles published in the same issue: Turk. J. Phys.,vol.25,iss.6.