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Thermally-induced optical bistability and temperature broadening of spectroscopic bands in Cr:ZnSe and Fe:ZnSe mid-IR laser materials. CHANDLER BERNARD, Troy University, RICK WATKINS, OZARFAR GAFAROV, VLADIMIR FEDOROV, SERGEY MIROV, University of Alabama at Birmingham — Cr:ZnSe and Fe:ZnSe chalcogenides are well established materials for mid-IR laser applications in the 2-6 μm spectral range. We report on the characterization of the absorption cross sections at $^5T_2 \leftrightarrow ^5E$ laser transition in the 77K-389K temperature range for these crystals. The obtained results allowed us to model thermally-induced optical bistability under pump radiation. For Cr:ZnSe, it was found that the position of the peak of the absorption coefficient shifted from 1770 to 1750 nm and its value decreased to 88% of the RT value when the crystal's temperature was increased from RT to 389 K. At wavelengths of 2040 nm and 1650 nm, it was observed that the increase in temperature from RT to 389 K did not induce change in absorption. The maximum change of the absorption cross-sections of $\sigma^{-1}d\sigma/dT$ = -1.6 X 10^{-3} K^{-1} and $\sigma^{-1}d\sigma/dT$ = 2.9 X 10^{-3} K^{-1} were measured at 1830 nm and 1530 nm respectively. The developed model predicts thermally-induced optical bistability under absorbed pump power >20W in the 3 mm long gain elements. This effect should be considered in the development of a high power laser system. It could also be used for temperature control of lasing parameters.

Chandler Bernard
Troy University

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