Nonlinear Change in Refractive Index and Transmission Coefficient of ZnSe:Fe2+ at Long-Pulse 2.94-μm Excitation

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Abstract.

An experimental study of the nonlinear changes in refractive index and transmission coefficient of single-crystal ZnSe:Fe2+, fabricated through the Fe-diffusion method, at long-pulse (~300 ns), sub-mJ, 2.94-mm Z-scan probing is reported. As well, a theoretical model based on the generalized Avizonis-Grotbeck equations is developed and applied for straightforward fitting of the open- and closed-aperture Z-scans, obtained for ZnSe:Fe2+ with different Fe2+ centers concentrations. The modeling results reveal that the contributions in the absorption and refractive index nonlinearities of ZnSe:Fe2+ are "common" resonant-absorption saturation (the minor part) and pulse-induced heating of the samples (the major part), which are strongly dependent on Fe2+ concentrations. Large values of the index change (>~10-3) and partial resonant-absorption bleaching (limited by ~50%), both produced via the thermal effect mainly, are the features of the ZnSe:Fe2+ samples inherent to this type of excitation.