Material preparation and infrared spectroscopy of diffusion doped Cr: ZnSe and Cr: CdTe

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— The preparation and infrared spectroscopy of diffusion doped Cr:ZnSe and Cr:CdTe windows will be reported. Cr$^{2+}$ doped II-VI semiconductors are of significant current interest as gain media in mid-infrared (2-3 µm) solid-state lasers. Compared to Cr:ZnSe, Cr:CdTe exhibits an extended infrared emission, which is of interest for laser applications beyond 3µm. Cr doping in ZnSe and CdTe was achieved through a thermal diffusion process controlled by temperature and time. Commercial CrSe powder was used as the dopant source in the diffusion experiments. Various samples of Cr:ZnSe and Cr:CdTe were prepared with Cr$^{2+}$ peak absorption coefficients ranging from $\sim 0.8$ cm$^{-1}$ to 28.7 cm$^{-1}$. The corresponding Cr$^{2+}$ concentrations ranged from $\sim 1 \times 10^{17}$ cm$^{-3}$ to $\sim 3 \times 10^{19}$ cm$^{-3}$ assuming absorption-cross sections of $1.1 \times 10^{-18}$ cm$^2$ for Cr:ZnSe and $2.2 \times 10^{-18}$ cm$^2$ for Cr:CdTe. For low Cr$^{2+}$ concentrations ($\sim 1 \times 10^{18}$ cm$^{-3}$) the room-temperature decay time varied between 5-6 µs for Cr:ZnSe and 2-3 µs for Cr:CdTe. The effect of Cr concentration quenching on the mid-infrared emission was observed for doping concentrations above $\sim 1 \times 10^{19}$ cm$^{-3}$.

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