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SPECTRAL PROPERTIES OF Er^{3+}-DOPED CHALCOGENIDE GLASSES

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Lanthanum sulphides glasses formed with sufficient proportions of Ga_2S_3 constitute a very convenient matrix for rare earth sulphides [1,2], and Pr^{3+}-doped Ga_2S_3:La_2S_3 (GLS) glasses have been recognized as one of the most promising candidates for fibre amplifiers operating at a wavelength of 1.3μm [3]. In this report, the spectral properties of chalcogenide glass of the molar composition $0.7Ga_2S_3$:$0.3La_2S_3$ doped with Er^{3+} are presented and discussed. Emission and absorption spectra and lifetimes of energy levels have been measured. The 2.7μm emission, as shown below, has been observed from chalcogenide glass for the first time. Radiative and non-radiative transition rates are calculated and compared with the measured lifetimes of interesting energy levels.

Comparing this glass with Er^{3+}-doped silica glasses, we show that the absorption and emission cross-sections of Er^{3+}:GLS are around 2.5 times higher, radiative transition rates are around five times higher due to its higher refractive index, while multiphonon non-radiative decay rates are around three orders lower due to its much lower phonon energy. Consequently there is a dramatic difference in excited state lifetimes between these two classes of glass. Taking account of the spectral properties of Er^{3+}:GLS, as well as the higher solubility for rare earth ions in GLS [1], we will briefly show the potential applications of this glass via a theoretical model.

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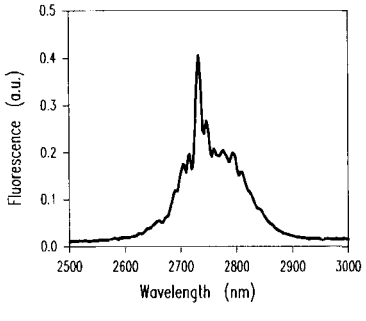

The 2.7μm emission from Er^{3+}-doped GLS