Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Infrared spectroscopy of Dysprosium doped KPb_2Br_5 and KPb_2Cl_5. PETER AMEDZAKE, EI BROWN, UWE HOMMERICH, Hampton University, SUDHIR TRIVEDI, Brimrose Corporation of America, JOHN ZAVADA, US Army Reseach Office — The infrared optical properties of rare earth doped crystals with narrow phonon spectrum (< 300 cm^{-1}) remains of current interest for applications in IR solid-state gain media. The maximum phonon energies of KPb_2Cl_5 and KPb_2Br_5 are only $\sim$200 cm^{-1} and $\sim$150 cm^{-1}, which reduce non-radiative decay through multi-phonon relaxations. In this work, we present spectroscopic results of Dy: KPb_2Cl_5 and Dy: KPb_2Br_5 for possible applications in mid-infrared gain media. The investigated materials were grown by horizontal and vertical Bridgman technique. Dy: KPb_2Cl_5 and Dy: KPb_2Br_5 exhibited characteristic Dy^{3+} absorption bands in the visible and infrared regions. Optical excitation at $\sim$800 nm resulted in the observation of a broad 4-5 μm mid-IR emission ($^6H_{11/2} \rightarrow \ ^6H_{13/2}$) at room temperature. The mid-IR emission lifetime was measured to be $\sim$5.5 ms for Dy: KPb_2Cl_5 and $\sim$3.8 ms for Dy: KPb_2Br_5, respectively. Based on temperature dependent lifetime studies and Judd-Ofelt calculations, the emission quantum efficiencies for the 4-5 μm bands were estimated to be near unity. More details on the IR optical properties of Dy: KPb_2Cl_5 and Dy: KPb_2Br_5will be presented at the conference.

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Date submitted: 27 Nov 2007 Electronic form version 1.4