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Infrared spectroscopy of Dysprosium doped KPb$_2$Br$_5$ and KPb$_2$Cl$_5$. 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$_2$Cl$_5$ and KPb$_2$Br$_5$ are only ~200 cm$^{-1}$ and ~150 cm$^{-1}$, which reduce non-radiative decay through multi-phonon relaxations. In this work, we present spectroscopic results of Dy: KPb$_2$Cl$_5$ and Dy: KPb$_2$Br$_5$ for possible applications in mid-infrared gain media. The investigated materials were grown by horizontal and vertical Bridgman technique. Dy: KPb$_2$Cl$_5$ and Dy: KPb$_2$Br$_5$ exhibited characteristic Dy$^{3+}$ absorption bands in the visible and infrared regions. Optical excitation at ~800 nm resulted in the observation of a broad 4-5 μm mid-IR emission ($^6$H$_{11/2}$ → $^6$H$_{13/2}$) at room temperature. The mid-IR emission lifetime was measured to be ~5.5 ms for Dy: KPb$_2$Cl$_5$ and ~3.8 ms for Dy: KPb$_2$Br$_5$, 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$_2$Cl$_5$ and Dy: KPb$_2$Br$_5$will be presented at the conference.

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