Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Spectroscopic Characterization of Thulium doped Potassium Lead Chloride for Potential Applications in Optical Cooling EI BROWN, HERBERT BROWN, UWE HOMMERICH, Hampton University, ALTHEA BLUIETT, Elizabeth City State University, SUDHIR TRIVEDI, Brimrose Corporation of America — Rare-earth doped solids have experienced increased attention for possible applications in anti-Stokes fluorescence cooling. Solid-state optical refrigeration offer several advantages over current bulky mechanical coolers including compact, lightweight, and vibration free. Most efforts have focused on optical cooling in Yb^{3+} doped solids and cooling down to ∼155 K has been demonstrated. In this work, the optical properties of Tm^{3+} doped KPC were evaluated as a potential solid-state material for laser cooling applications. Following 1907 nm excitation, Tm:KPC exhibited infrared emission with a center wavelength of 1806 nm arising from the $^3F_4 \rightarrow {}^3H_6$ transition of Tm^{3+} ions. Under 1907nm pumping conditions, it was estimated that a quantum emission efficiency of at least 95% is required to achieve a net cooling effect in Tm:KPC. Based on temperature dependent decay time studies the emission quantum efficiency of Tm:KPC was estimated to be only ∼75%. Employing the energy-gap law, non-radiative decay through multi-phonon relaxation is predicted to be negligibly small in Tm:KPC. Concentration quenching effects and/or energy transfer processes to other defects seems most likely to be responsible for the low quantum efficiency.

Ei Brown
Hampton University

Date submitted: 17 Nov 2012 Electronic form version 1.4