Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Er,Yb:ZrO_2 / Eu:Y_2O_3 Core/Shell Assemblies as Potential Temperature Sensors in Explosions[1] HERGEN EILERS, RAY GUNAWIDJAJA, THANDAR MYINT, Washington State University, APPLIED SCIENCE LABORATORY TEAM — We have recently demonstrated the use of nanophase Eu:Y_2O_3 and Eu:ZrO_2 as temperature sensors in explosions. Initial measurements showed that each of these materials is suitable for a certain temperature range – Eu:Y_2O_3 covers the range from about 500 K to about 900 K, and Eu:ZrO_2 the range from about 800 K to about 1300 K. In order to have one material that can cover a wider range of temperatures, we have prepared core/shell assemblies of these host materials with different dopants. Here we report on the synthesis and characterization of core/shell assemblies consisting of Er,Yb:ZrO_2 cores and Eu:Y_2O_3 shells. The Er,Yb:ZrO_2 core was synthesized via forced hydrolysis and the Eu:Y_2O_3 shell was synthesized via homogeneous precipitation. Subsequently, these assemblies have been heated by a pyroprobe and a CO_2 laser for short periods of time. Heat-induced changes in the materials lead to changes in the optical spectra, which can then be correlated with temperature. The Er,Yb:ZrO_2 core emits upconverted light in the red and green when excited with 970 nm, while the Eu:Y_2O_3 shell emits in the red when excited with 532 nm. These spectra can be measured separately allowing us to determine temperatures over a wide range.

[1]This work was supported by the Defense Threat Reduction Agency, Basic Research Award # HDTRA1-10-1-0005 to Washington State University.

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Date submitted: 06 Feb 2013 Electronic form version 1.4