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Luminescent Sensors for Tracking Spatial Particle Distribution in an Explosion[1] HERGEN EILERS, RAY GUNAWIDJAJA, HELENA DIEZ-YRIEGA, Washington State University, FORREST SVINGALA, AMBER DANIELS, JAMES LIGHTSTONE, NSWC IHEODTD, WASHINGTON STATE UNIVERSITY COLLABORATION, NSWC IHEODTD COLLABORATION — We previously developed and tested thermally sensitive particles that, when seeded into an explosive event, flow with the expanding post-detonation fireball and provide ex-situ measurements of this thermal environment. This current work presents the development and testing of tracking particles that are used in concert with the thermally sensitive particles to encode the initial positions of materials recovered for ex-situ analysis. These tracking sensors consist of fully-crystallized (c) rare-earth-doped yttria particles such as c-Dy:Y_2O_3, c-Sm:Y_2O_3, and c-Er,Yb:Y_2O_3. The temperature sensors consist of mixtures of precursor (p) and fully crystallized materials such as p-Eu:Y_2O_3/c-Tb:Y_2O_3 or p-Eu:ZrO_2/c-Tb:Y_2O_3. Three mixtures containing one of the tracking sensors and one of the temperature sensing mixtures are placed at different locations within the chamber. Post-detonation, the tracking particles in the debris are excited by 365 nm light, resulting in different color luminescence, and allowing for potential visual inspection of the particle distribution originating from the different locations. Meanwhile, the temperature is determined from spectral changes of the precursor sensor materials or by comparison of the precursor sensor materials with the Tb:Y_2O_3 intensity reference.

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Hergen Eilers
Washington State Univ

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