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Sub-Second Laser Heating of Thermal Impulse Sensors[1] HERGEN EILERS, RAY GUNAWIDJAJA, HELENA DIEZ-Y-RIEGA, BENJAMIN ANDERSON, Washington State University, WASHINGTON STATE UNIVERSITY TEAM — We are reporting on thermal impulse sensors capable of measuring temperature and time for sub-second heating events. We previously tested these sensors in our laboratory for temperatures above about 700 °C and for heating duration times between 2 s and 60 s. We are now evaluating these sensors for an extended temperature range and for heating times as short as 100 ms. The functionality of these sensors is similar to that of our temperature-only sensors – rare-earth ions are used to monitor temperature-induced phase changes. However, in this case two sensor materials with different phase change kinetics are mixed. In addition, a fluorescence standard is included. The spectral changes in the sensor materials depend on temperature and heating time. By combining two sensor materials, it is possible to extract information about both of these variables. The induced spectral changes depend on the specific phase changes in the sensor materials. At lower temperatures, decomposition processes dominate these changes. As the temperature increases, nucleation and grain growth become more important. The kinetics of these processes is expected to be different for the different phases. As such, calibration requires mapping of the phase diagram followed by a kinetic analysis within each phase.

[1]Defense Threat Reduction Agency, HDTRA1-10-1-0005

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