INVESTIGATIONS ON THE EFFECT OF IRRADIATION SPOT SIZE AND SAMPLE SIZE IN NUCLEAR THERMAL TESTING

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Full scale nuclear thermal testing of whole weapon systems or large equipment only is possible with a TRS, which produces the thermal radiation by the combustion of aluminum powder and liquid oxygen. For different reasons (availability, costs, reproducibility, pulse shape, etc.) very often tests with xenon lamp lab facilities or solar furnaces are performed. In that case only small samples (a few centimeters) can be irradiated homogenously, or in the case of larger samples, only a limited surface area can be tested. Then the question comes up whether tests with reduced sample size or irradiation spot size will deliver temperature levels and material damage comparable to a full scale thermal test.

In a French-German research cooperation a high number of samples with paint layers were exposed to thermal pulses generated by different facilities: French solar furnace at CEP Odeillo, German TRS and xenon lamp lab facilities at WIS in Munster. For each facility samples in different size were used, ranging from 3 cm x 3 cm up to 50 cm x 50 cm. In addition tests with diaphragms of different diameter were conducted in order to reduce the heating spot size and to analyze the effect on rear face temperature increase and mass losses. Data show that tests with very small irradiation spot size and tests with very small samples can result in enhanced material damage per surface unit and in reduced rear face temperature increase.