

Western States Section Combustion Institute Fall Technical Meeting  
Albuquerque, NM  
October 14-15, 2019

SAND2019-9263C

## **Solid-Dominant Ignition Thresholds for Cellulose Under Extreme Irradiation**

Jeffrey D. Engerer  
Alexander L. Brown

Sandia National Laboratories<sup>1</sup>  
PO Box 5800  
MS 1135  
Albuquerque, NM 87185-1135

### **Abstract**

Ignition of solid materials under convective and/or radiant heating often depends on complex interactions between the solid and fluid phase. Under extreme irradiation ( $\gg 100 \text{ kW/m}^2$ ), historical data suggest the ignition of cellulosic papers is dependent on a simplified set of physics. The initiation and sustainment of ignition is determined from the thickness and thermophysical properties of the solid, and the intensity and duration of radiant heat source. Historical work leverages this reduced parameter set to generate a graphical ignition map, based on two normalized quantities for flux and fluence. We leverage this technique and historical data to produce empirical correlations from the historical data, capturing ignition of cellulose for a range of heating conditions and thermophysical properties. These empirical correlations capture the aleatoric and/or model-form uncertainty with prediction intervals, allowing the user to assess the probability of ignition. We also recommend a small permutation to the historically established normalized variables, collapsing the ignition maps even further. This approach allows simple assessments of ignition modes, transient or sustained, with negligible computational overhead.

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<sup>1</sup> Sandia National Laboratories is a multimission laboratory operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc. for the United States Department of Energy's National Nuclear Security Administration under Contract No. DE-NE0003525.