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**Turbulent Combustion in Aluminum-air Clouds for Different Scale Explosion Fields** ALLEN KUHL, Lawrence Livermore Natl Lab, KAUSHIK BALAKRISHNAN, NASA Jet Propulsion Lab, JOHN BELL, VINCENT BECKNER, Lawrence Berkeley Natl Lab — We have studied turbulent combustion effects in explosions, and proposed heterogeneous continuum models for the turbulent combustion fields. Also we have proposed an induction-time model for the ignition of Al particle clouds, based on Arrhenius fits to the shock tube data of Boiko. Here we explore scaling issues associated with Al particle combustion in such explosions. This is a non-premixed combustion system; the global burning rate is controlled by rate of turbulent mixing of fuel (Al particles) with air. For similitude reasons, the turbulent mixing rates should scale with the explosion length and time scales. However, the induction time for ignition of Al particles depends on an Arrhenius function, which is independent of such scales. To study this, we have performed numerical simulations of turbulent combustion in unconfined Al-SDF (shock-dispersed-fuel) explosion fields at different scales. Three different charge masses were assumed: 1-g, 1-kg and 1-T Al-powder charges. We found that there are two combustion regimes: an ignition regime—where the burning rate decays a power law function of time, and a turbulent combustion regime—where the burning rate decays exponentially with time.

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