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Influence of Thermal Radiation on Layered Coal-Dust Explosions[1] SWAGNIK GUHATHAKURTA, RYAN HOUIM, University of Florida — There is significant debate on the role of thermal radiation on the propagation of coal-dust explosions. To date, numerical simulations of dust explosions either completely neglect radiation or use crude approximations. Here, we use numerical simulations to explore the role of radiation on coal-dust explosions by solving the radiation transport equation (RTE). The multiphase model couples multidimensional kinetic theory-based granular Eulerian multiphase model to a compressible reactive gas. The RTE is coupled to the flow using the FP3 approximation. Radiation is assumed to be gray with cold, black boundaries. Global reaction models are used to describe coal devolatilization, char combustion, and volatile (methane) combustion. Results from the simulations show that radiation may have a significant influence on the dust explosion. In some cases, radiation enhances flame propagation by transferring additional heat to cold reactants, in other cases radiation losses enhance quenching of the flame. Radiation also has significant impact on the structure of the flame and peak flame temperature. Our ongoing work is exploring the influence of modeling choices such as chemical kinetics and spectral accuracy.

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