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Worcester Polytechnic Institute, Worcester, MA 01605. **Predictive scenario for  
methane-air-dust fires in a mining passage: Effect of compressibility and non-  
homogeneous dust distributions.**

Accidental gas/dust explosions constitute a tremendous hazard for personnel and equipment in industries, such as coal mining industry that has one of the highest occupational fatality and injury rates, claiming hundreds of lives annually. Among various factors driving fires in coal mines, such as turbulence, acoustics, wall friction and obstacles; combustion instabilities, dust impurities and a finger shape of the flamefront play the dominant role. Focusing on these acceleration mechanisms, a predictive scenario of a methane-air- dust fire in a mining passage is developed, and the characteristic stages of the flame evolution are identified. Starting with gaseous fuels, the formulation is then extended to dusty-gaseous medium, with combustible and inert dust as well as their mixture employed. Specifically, the effects of equivalence ratio as well as dust size and concentration on the flame evolution are systematically investigated. While initial formulations are assumed to be incompressible and distribution of gas-dust particles is homogeneous, later, formulations are separately extended to compressible and non-homogenous dust distribution scenarios.

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