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Flame propagation in dusty gases NICHOLAS POOLE, Northwestern University, MOSHE MATALON, University of Illinois at Urbana-Champaign — The combustion of finely atomized dust particles is of great importance to many practical technologies. While the study of flame propagation through gaseous fuel-air mixtures is relatively well developed, there currently exists a lack of fundamental understanding on the mechanisms that govern flame propagation through dust clouds. Unlike homogeneous gas flames, the study of metal particle combustion is highly complex, involving chemical and physical processes occurring in multiple phases. The mathematical description requires particular importance to be placed on the processes occurring in the condensed phase, for they present novel challenges in dust combustion modeling and ultimately provide its most distinguishing characteristics. Typical reaction zones are confined to a thin region of space and necessitate the use of perturbation methods with distinguished limits in order to capture the essential behavior of the system. Through matched asymptotic expansions we are able to arrive at an expression for the speed of the propagating flame front in terms of important combustion parameters such as mixture strength, particle loading, and particle size.

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