# Global classical solutions for a free boundary problem modeling combustion of solid propellants

DARIO PIEROTTI and MAURIZIO VERRI

*Dipartimento di Matematica, Politecnico di Milano, piazza Leonardo da Vinci 32, I-20133 Milano, Italy*

**Abstract.** We study a free boundary problem for the heat equation in one space dimension, describing the burning of a semi-infinite adiabatic solid propellant subjected to external thermal radiation (typically, a laser). The model includes the presence on the moving solid-gas interface (the free boundary) of both heat release, due to propellant degradation, and conductive heat feedback from the gas phase reactions. The pyrolysis law and the flame submodel, relating burning rate to the boundary temperature and the heat feedback, respectively, satisfy general and physically valuable conditions. We prove existence and uniqueness of a classical solution, local in time, for continuous initial thermal profiles and a property concerning the smoothness of the solution up to the free boundary. In addition, if the initial datum is exponentially bounded at infinity, we derive the main result of existence in the large and some uniform bounds for the solution.

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