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EXPLORING THE PERFORMANCE OF INNOVATIVE SOLID FUEL RAMJETS

Abstract

The paper has the goal to theoretically and experimentally investigate the performance of a solid ramjet, based on paraffin, HTPB (hydroxyl-terminated polybutadiene), and polyethylene. The investigation extends to the incorporation of various additives, including MgB2, carbon, Boron, Aluminum, and CeO2, serving as energetic particles within the propellant grains. These additives are examined at different concentrations, ranging from 5To assess and validate the practical implications of these propellant formulations, the research employs a combination of theoretical models, RANS simulations and experimental analysis based on the test bench of the SIA ASPlab propulsion laboratory. Numerical simulations include the intake, the combustion chamber and the nozzle, in order ensure a comprehensive understanding of the engine behaviour under varying ramjet flight conditions in terms of Mach and altitudes, to identify optimal configurations that can significantly improve the efficiency and functionality of the entire propulsion system and to provide operative and initial conditions for the experimental setup. Validation of numerical results will contribute to enhancing numerical modelling.

Keywords: solid ramjet, CFD, intake, integrated engine