SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (2) (2)

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REGRESSION RATE MODELS VERSUS EXPERIMENTAL RESULTS FOR HYBRID ROCKET ENGINES BASED ON H2O2 AND HTPB/AL

Abstract

The regression rate of the solid fuel is a major factor in hybrid rocket engine (HRE) design. It is very important to have a reliably-predicted regression rate to design an application-related hybrid rocket engine which will meet the required thrust profile.

Many different models have been proposed with very different levels of complexity and are related to a broad number of HRE propellant types and combustion mechanisms. Often they have a lack of generality concerning the HRE working regime in terms of pressure, oxidizer mass flow and scaling.

The regression rate predictions by some major models are calculated for the test setup and compared to experimental results of the HRE demonstrator, developed within the DLR research program AHRES. AHRES aims to develop a design tool for HREs based on own experiments.

The HRE demonstrator of the AHRES program is equipped with a fuel grain in telescope geometry which is designed for a constant burning surface. The fuel consists of either pure HTPB or HTPB with aluminium. Hydrogen peroxide with a concentration of 87.5

Important parameters being measured at the newly reactivated test facility in Trauen (north Germany) are engine thrust, regression rate, chamber pressure, temperature and the oxidizer mass flow. The completion of the combustion process is detected by a gas analyzer for the components oxygen, carbon monoxide and carbon dioxide. The exhaust flame temperature is measured by a two colour pyrometer. The suitability of different regression rate models for the AHRES hybrid engine is discussed and graphically displayed.