

Modeling Combustion and Heat Transfer in a Single-Element GCH₄/GOX Rocket Combustor

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Abstract - The present paper focuses on the numerical modeling of the combustion and heat transfer processes occurring in a GCH₄/GOX rocket combustor, which was tested experimentally at the Technical University of Munich. A CFD model, using a RANS formulation to resolve the turbulent flow in the combustor, is set up and a grid independence study is performed. Three different combustion models are applied and the results are compared among each other, as well as to the experimental data. The applied models are an equilibrium chemistry model, a non-adiabatic flamelet model, and laminar finite rate chemistry. The models vary in fidelity as well as computational expense. Their ability to resolve the underlying physical processes of the reactive flow in the combustion chamber is investigated and discussed.

Keywords: CFD, RANS, Combustion Modeling, Rocket Combustor, Methane, Heat Transfer