

SPACE PROPULSION SYMPOSIUM (C4)

Propulsion System (1) (1)

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RESEARCH ON THERMAL DECOMPOSITION OF HYDROGEN PEROXIDE.

Abstract

Highly concentrated water solution of hydrogen peroxide also so called HTP – High Test Peroxide, or RGHP – Rocket Grade Hydrogen Peroxide is considered as a possible alternative solution comparing to widely used hydrazine for satellite propulsion application. The HTP decomposition process is strongly exothermic and self-accelerating if heat is not efficiently dissipated. During the process the mixture of hot gases – steam and oxygen is produced – the higher initial H₂O₂ concentration, the higher temperature of decomposition gases (ab. 1100 K for 95%). High increase of temperature and volume (ab. 4500 times for the highest concentrations) enables using products of decomposition of H₂O₂ for many applications e.g. for monopropellant or hybrid rocket thrusters. In many cases, the key issue is initiation and also rapid, effective and stable decomposition process. It can be started catalytically or thermally. During the decomposition process the metallic catalyst absorb some heat and lower the dynamics and performances of the process. Also their susceptibility to melt because of high temperature of the process and poisoning of the bed by H₂O₂ stabilizers limits the lifetime of catalytic bed and rises the cost. Catalytic decomposition is well known and that is why authors are going to deal with thermal decomposition of H₂O₂. Research was focus on understanding of the mechanisms of decomposition and influence of initial and flow conditions on dynamic of a process. For this purpose a research stands was build. The stand was based on small stainless steel and passivated chamber. It was equipped with thermocouples, pressure transducers and measurement orifice. Also a thermovision camera was used to measure the exact temperature of the research facility. In the initial phase of the research simple resistance wire was used as a heating element but few configurations are going to be examined. Basic parameters such as initiation temperature in isothermal mixture of HTP, initiation temperature from hot surface, minimum initiation energy and also the temperature of products of decomposition are presented as a research results. The decomposition rate was also measured. This paper presents the initial phase of a reseach on thermal decomposition of highly concentrated hydrogen peroxide.