SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems II (2)

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ABOUT STABILITY OF ROCKET PROPULSION USING PASTE-LIKE PROPELLANT

Abstract

Researches of rocket engines on pastelike fuel show their efficiency in quite a number of practically important tasks [1]. In some of the experiments the occurrence of irregular fluctuations of pressure was been marked. Taking into account efficiency of this new type of engines it makes sense to investigate his stability. The combined model which is taking into account a delay gasification of a liquid phase (as in Liquid Propellant Rocket Engines, Crocco-Artamonov's model [2,3]) and Zeldovich - Novozhilov's mechanism [4] for Solid Propellant Rocket Motors is considered in the report. Methods of small deviations and of D-partitioning are used for definition of border of stability in a plane of parameters: - the relation of a constant of time of the chamber of combustion and of the fuel - the delay of the gasification of the liquid component - the pressure drop on spinneret' block - the temperature sensitivity of the burning velocity of a solid component - a share of liquid and solid components in fuel. It is shown, at reduction of pressure drop and at increase of temperature dependence of burning velocity the occurrence of low-frequency fluctuations is possible that can be promoted by two competing factors. The first is connected to size of a power in relationship of the fuel rate from pressure drop - 2-4 (instead of for usual liquids). The second represents a share of a evaporating liquid' phase. Except for that demands additional research of distinction between damping properties of liquid and pastelike fuel. The submitted combined model allows to take into account and other well-known factors determining instability both Liquid Rocket Engines and Solid Propulsion: an power in the law of the burning velocity, pressure derivative of the burning velocity and initial temperature of fuel derivative of the temperatures of a surface. References. 1. Protsan Y., Ivanchenko A.N., Bondarenko S.G. Rocket Propulsion Using Unitary Paste-Like Propellant. 59 IAC. Pap. IAF-08-C.4.2.10. Glasgow. – Sept. 29- Oct. 3. 2008. 2.Crocco L., Sin-I Cheng. Theory of Combustion Instability in Liquid Propellant Rocket Motors. London. 1956. 3. Makhin V.A., Prisniakov V.F., Belik N.P. Dynamics of Liquid Rocket Propulsion. Moscow. Mashinostroyeniye. 1969. 4. Prisniakov. V.F. Dynamics of the Solid Rocket Motors. Moscow. Mashinostroyeniye, 1984. 5. Prisniakov. V.F. Dynamics of the Liquid Rocket Propulsion Plants and Feeding Systems. Moscow. Mashinostroyeniye. 1983.