

Prospects for the use of nitrogen-containing single-component rocket propellants

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The goal of this work is to analyze the possibility of using existing monopropellant compositions based on aqueous solutions of high-energy nitrogen-containing substances as the main propellant for low-thrust engines, for example, for meteorological rockets, for upper-stage engines, and in spacecraft control engine systems. This paper presents an approach that considers the selection and justification of ingredients based on renewable energy sources, the analysis being carried out primarily from standpoint of the availability of propellant components and their safety and energy efficiency. It is proposed that the energy of unitary reducing agent – oxidizer chemical propellants (energy-saturated compositions) be used as an alternative source. The development of nonhydrocarbon nitrogen-containing alternative energy sources with the possibility of their conversion and accumulation into the planetary nitrogen, oxygen, and water cycles is an urgent problem. The paper presents detailed information on propellant mixtures of nitrogen-containing substances as oxidizers and considers a number of reducing agents, such as alcohols, amides, etc. in composition with high-energy additives (aluminum, magnesium). The calculated results obtained meet the objectives and demonstrate that the compositions considered can be used as the main propellant for low-thrust engines.

The advantages of the new propellant technology: availability, a low cost, produceability, environmental friendliness, a relatively low toxicity, and, primarily, a simpler design of the propulsion system and launch equipment.

The proposed propellant composition, which is under test, is planned for use in the sustainer engines of ultralight suborbital rockets with the possibility of further development to an orbital rocket system.

Keywords: *propellant technologies, rocket propellants, monopropellant, "green" propellant, ammonium nitrate, chemical thermodynamics of propellant, low-thrust jet engine.*

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Received on September 12, 2022,
in final form on October 3, 2022