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THERMIONIC EMISSION METHODS FOR COOLING THE HEAT SHIELDS OF REENTRY VEHICLES IN THE INTERESTS OF STUDYING THE PLANETS OF THE SOLAR SYSTEM WITH AN ATMOSPHERE

Abstract

Currently, there is an increase in the number of developments in the field of rocket and space technology related to the exploration of outer space around the world. For example, stations are being developed to study the planets of the Solar System and the Sun itself, as well as interplanetary spaceships. Many automated stations (AS) under development are supposed to land on the surface of the planet, including on a planet with an atmosphere. Such AS has thermally stressed elements (chambers of power-engine installations, heat shields of descent vehicles, etc.). On the other hand, it is known that the service life and reliability of such elements increases significantly as their operating temperature decreases. Since 2009 (in the USA since 2014), the BSTU VOENMEH named after D.F. Ustinov has been developing thermionic cooling (TC) of thermally stressed elements of rocket and space technology, which accompanies the phenomenon of thermionic emission - the emission of electrons by heated material. The thermal effect in other known areas reaches values of the order of 700-900 S. Then it is implemented in the following way. The hot element of rocket and space technology, for example, the heat shield (HS) of the lander on the surface of Mars, Venus and other planets, is covered with a layer of material with high thermal emission of electrons when heated. During the descent in the atmosphere, electrons "evaporate" from the surface of the surface coating. As a result, the surface with a thermionic coating is cooled. The more electrons left, the stronger the cooling. Further, the electrons are perceived by the element-the anode, located in the part of the automatic station, which is much easier to remove heat from than from the HS (for example, the shadow area). In this case, there is a decrease in temperature, temperature stresses and deformations of the responsible element and the transfer of heat to the element less loaded.