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DETERMINATION OF THE OPTIMAL CAPILLARY STRUCTURE AND MATHEMATICAL MODEL OF THE HEAT PIPE MADE USING ADDITIVE TECHNOLOGY FOR FURTHER USAGE FOR THE SPACECRAFT DESIGN

Abstract

Heat pipes are extremely effective for heat transfer in a spacecraft structure. The installation requires a large number of procedures: assembly operations, determination of parameters of thermal interfaces, ground testing. Embedded to the structure heat pipes is an alternative way. At the same time such structure should be manufactured as a single part using additive technologies. The structure of the heat pipe contains channels for gas transmission, channels for liquid transmission, evaporation and condensation zones. Capillary structures are provide the liquid to the evaporation zone. In this work, a stand was developed and various AlSi10Mg aluminum alloy capillaries created using additive technology were tested. The influence of mechanical and chemical post-processing was also taken into account. Acetone was used as the working fluid. By experiments the zone of applicability of the Navier-Stokes equation was determined. A mathematical model of a 3D printed heat tube was created. Vacuum tests and a number of other tests were carried out. The resulting heat pipe is less efficient than the classic one, but it can be embedded where the classic one cannot be installed.