IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Robotic/Thermal/Fluidic Systems (7)

Author: Mr. Nikolay Mullin
Skolkovo Institute of Science and Technology, Russian Federation, n.mullin@skoltech.ru

Mr. Denis Galagan
Skolkovo Institute of Science and Technology, Russian Federation, Denis.Galagan@skoltech.ru
Mr. Vladimir Kalyaev
Skolkovo Institute of Science and Technology, Russian Federation, v.kalyaev@skoltech.ru
Mrs. Maria Grol
UC Rusal, Russian Federation, grol.maria.s@gmail.com

DEVELOPMENT OF A THERMAL DESIGN MODEL FOR A SMALL SPACECRAFT WITH INTEGRATED HEAT PIPES

Abstract

Additive technologies allow heat pipes to be integrated into the spacecraft structure. However, there are also restrictions on the model for 3D printing. Among them constraints on the printing part dimensions, minimum wall thickness, it is necessary to add supporting structures for both external and internal cavities. These limitations are generally not critical in case if modeling is adjusted to the 3D printing. Embedded heat pipes in the design of spacecraft allows them to create unique thermal properties based on experimentally obtained values of thermal conductivity. As a part of this work, an approach that allows usage of well-known CAD systems for the design of such models was developed. A satellite being developed at Skoltech was selected for the thermal modelling, as well as a small-sized spacecraft being developed at MSTU. N. E. Bauman "Yareelo". "Yareelo" is a 1.5 U cubesat. Its design is made using the classical approach. The thermal bridge that removes heat from a special detector is made using 3-d printing technology and contains built-in heat pipes with acetone. The launch is expected in the summer 2020. The experiment will also evaluate the effect of weightlessness on the efficiency of the embedded 3D printed heat pipe structures.