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Author: Ms. Larissa Krambeck
Universidade Federal de Santa Catarina UFSC, Brazil

Mr. Kelvin Guessi Domiciano
Universidade Federal de Santa Catarina UFSC, Brazil
Mr. Guilherme Carpes Zonta
Universidade Federal de Santa Catarina UFSC, Brazil
Mr. Luis Alonso Betancur Arboleda
Colombia
Ms. Sabrina Chichinelli
Universidade Federal de Santa Catarina UFSC, Brazil
Prof. MARCIA BARBOSA HENRIQUES MANTELLI
Universidade Federal de Santa Catarina UFSC, Brazil
Dr. Luca Pagliarini
Università degli Studi diParma, Italy
Prof. Fabio Bozzoli
Università degli Studi diParma, Italy

PULSATING HEAT PIPE LABORATORY TESTS FOR A MICROGRAVITY SUB-ORBITAL EXPERIMENT

Abstract

In the last decades, satellites and spacecraft have become more sophisticated, and consequently, the onboard electric/electronic systems have increased their demand for more efficient thermal control. Considering that most technologies for the thermal management of electronics in space applications involve two-phase devices, many research groups concentrate efforts on improving the performance of heat pipes and similar devices under microgravity conditions. In this context, two flat plate pulsating heat pipes (PHPs) for the thermal management and heat dissipation of electronics, such as those aboard satellites and spacecraft, were specially developed for future tests aboard the VSB-30 sub-orbital rocket in the Igaratá Mission, within the microgravity program of the Brazilian Space Agency (AEB). Both two-phase devices contain 26 round cross-section channels, one with ultra-sharp lateral grooves in the evaporator. Two heat sinks were tested: a water-cooling bath for the thermal characterization of the PHPs and a copper box with a PCM (dodecahydrate dibasic sodium phosphate) to be qualified as heat storage for future microgravity tests. Ethanol was used as the working fluid. The two-phase devices were experimentally investigated and compared with each other using the best filling ratio previously determined. Besides microgravity data of the thermal behavior of the PHPs, this research also proposes an efficient alternative cooling method, the PCM storage, to be used as a heat sink in this and other future microgravity tests.