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MANUFACTURING OF A LIGHTLY LOADED REUSABLE THERMAL INTERFACE FOR SPACE APPLICATIONS

Abstract

A novel approach in satellite development is redesigning the known state-of-the-art monolithic bus architecture into an innovative system design based on modular building blocks. A fully operational satellite can be built by combining several modules with a standardized form factor but individual functionality. This design approach can help to reduce the costs and development time. Standardized interfaces for mechanical connection and to distribute data, power and heat through the satellite are a key issue in the evolution towards a modular spacecraft.

The modularization of space systems also would be a major step towards on-orbit servicing missions, as it makes replacing or upgrading of components feasible. To ensure this great opportunity the interfaces have to be reusable too.

Currently DARPA's Phoenix program and DLR's iBOSS project are trailblazers in that field of research. iBOSS has designed a centralized interface combing all already mentioned four interface characteristics in one component. The thermal interface (TIF) is a ring positioned concentrically around the mechanical interface. Simulations have shown that a high performance TIF between neighboring blocks will reduce thermal stresses within the system and will also reduce the power consumption of the thermal control system of a modular satellite.

However, investigations have shown that common Thermal Interface Materials will not fulfill all iBOSS requirements and constraints. Due to this copper composite materials reinforced with carbon nanotube (CNT) have been developed. It will be prepared via powder metallurgy methods combined with hot extrusion to get a near to parallel alignment of the CNTs at the contact surface.

Several production steps are required to fabricate a TIF in the desired shape and for utilization of the face surface. This paper focusses on these steps and on the integration into the 4-in-1 iBOSS interface.