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EMPIRICAL EVALUATION OF THERMAL CONTACT RESISTANCE OF BOLTED JOINT CONFIGURATIONS EMPLOYED IN SATELLITE APPLICATIONS FITTED WITH INTERFACE MATERIALS UNDER VACUUM CONDITIONS

Abstract

This paper presents the results of the experiments conducted with two different test setups, representing the prevalent configurations of bolted joints and structural geometries in wide usage in satellites, to evaluate the thermal contact resistance across bolted joints when fitted with a selection of several thermal pads and silicone grease and subjected to heat flux in vacuum conditions. The first test setup includes a special bolt and washer configuration frequently employed in spacecraft designs, not studied comprehensively hitherto. Test assembly contains two aluminum sheets with interface fillers bolted together using a flat washer between the bolt head and the upper sheet and a spring washer between the nut and the bottom sheet. The mentioned assembly is sandwiched between a copper slab and an aluminum slab on top of which a heater is installed. The whole assembly is attached to the base plate of a thermally controlled vacuum chamber. The second test setup contains an empty aluminum box which is jointed to an aluminum sheet using interface fillers. The aluminum sheet is in turn bolted to an aluminum slab. An electrical heater is mounted on the top of the box on its door. Again, the whole setup is installed in the vacuum chamber. For a constant heat flux and at low temperature of chamber's base plate temperature difference is measured across the interface to determine the thermal contact resistance of the bolted joint. Finally the results are discussed and the effects of filler parameters like thickness on thermal contact resistance are studied. These series of tests are designed to facilitate selection of the best performing thermal fillers in satellite thermal applications.