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ELECTRON BEAM WELDING OF FLEXIBLE THERMAL CONDUCTIVE STRUCTURE FOR HEAT SWITCH

Abstract

Flexible thermal structures are inseparable parts of thermal design in space applications – such as Miniaturized Heat Switch (MHS). In this case, the flexible thermal structure shall allow the movement and mechanical switching ON/OFF of the thermal conductive path. However conventional manufacturing processes do not allow extremely volumetrically-efficient solutions with low weight and custom shape. This can be achieved using electron beam welding due to its high energy absorption by material, penetration and beam set-up options. This paper presents the initial sample parameters and welding parameters for connection of copper wire/foil structure and few millimetres wide copper plate. To get a more volumetrically-efficient solution the welding technique can be used to melt the metal and create sufficient contact realized by pure metal only which prevents additional thermal resistances. Unfortunately, the welding of copper and aluminium is problematic due to their high thermal conductivity and surface reflectivity. This creates a problem for conventional welding techniques and laser welding. Using Electron beam welding, it is possible to create high conductive interface between the thin copper plate and wire/foil copper structure by melting the small amount of metal to let it penetrate the flexible structure. A very thin interface plate and flexible structure shall be at the end of the welding. The results can be useful for the design of thermal straps and braided structures in different applications. Novel solution of flexible thermal conductive structure manufacturing is described in this paper.