

Braze Development of Graphite Fiber for Use in Phase Change Material Heat Sinks

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Hamilton Sundstrand (HS), together with NASA Johnson Space Center, developed methods to metallurgically join graphite fiber to aluminum. The goal of the effort was to demonstrate improved thermal conductance, tensile strength and manufacturability compared to existing epoxy bonded techniques. These improvements have the potential to increase the performance and robustness of phase change material heat sinks that use graphite fibers as an interstitial material. Initial work focused on evaluating joining techniques from 4 suppliers, each consisting of a metallization step followed by brazing or soldering of one inch square blocks of Fibercore graphite fiber material to aluminum end sheets. Results matched the strength and thermal conductance of the epoxy bonded control samples, so two suppliers were down-selected for a second round of braze development. The second round of braze samples had up to a 300% increase in strength and up to a 132% increase in thermal conductance over the bonded samples. However, scalability and repeatability proved to be significant hurdles with the metallization approach. An alternative approach was pursued which used nickel and active braze allows to prepare the carbon fibers for joining with aluminum. This approach was repeatable and scalable with improved strength and thermal conductance when compared with epoxy bonding.