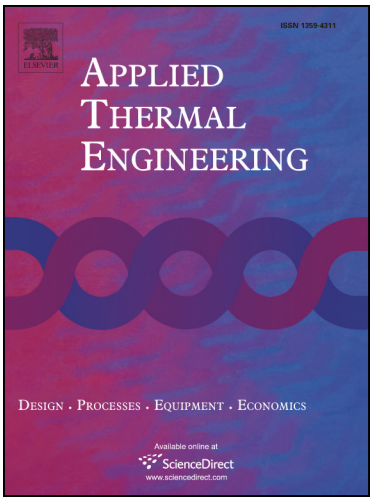

Research Paper

The passive thermal management system for electronic device using low-melting-point alloy as phase change material

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The passive thermal management system for electronic device using low-melting-point alloy as phase change material

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Abstract:

In this paper, the alloy with melting point of 334.15K was prepared and successfully composited with carbon foam (Poco foam). From the systematic test of thermal properties, Low-melting-point alloy (LMPA) shows some considerable advantages, such as high conductivity (up to 50 times of paraffin's), low thermal expansion and large volume latent heat (2.11 times of paraffin's). The numerical investigation of the thermal performance of the LMPA-based heat sink is based on enthalpy-porosity method. The numerical results are validated by experimental data. Comparing with paraffin (RT60) that has a similar melting point of 333K, the main finding of the investigation is that the thermal management performance is much better that the LMPA can effectively extend the protection time to nearly 1.5 times longer as well as reduce the heater's temperature by up to 15K during the heating period. Unlike the organic phase change material (PCM), the natural convection is nearly negligible owing to its much smaller thermal expansion coefficient and larger liquid viscosity, which means that the orientation and position has almost no effect on performance of the LMPA-based heat sink. In spite of the latent heat loss, the heat transfer performance is effectively improved by adding Poco foam that the heater's temperature could be managed more uniformly with LMPA/Poco foam composite-based heat sink during the melting process. These results indicate that for some passive thermal management system with high heat flux, LMPA and LMPA/Poco foam composite could be preferred to serve as promising PCM

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