World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:15, No:03, 2021

Thin Film Thermoelectric Generator with Flexible Phase Change Material-Based Heatsink

Authors : Wu Peiqin

Abstract : Flexible thermoelectric devices are light and flexible, which can be in close contact with any shape of heat source surfaces to minimize heat loss and achieve efficient energy conversion. Among the wide application fields, energy harvesting via flexible thermoelectric generators can adapt to a variety of curved heat sources (such as human body, circular tubes, and surfaces of different shapes) and can drive low-power electronic devices, exhibiting one of the most promising technologies in self-powered systems. The heat flux along the cross-section of the flexible thin-film generator is limited by the thickness, so the temperature difference decreases during the generation process, and the output power is low. At present, most of the heat flow directions of the thin film thermoelectric generator are along the thin-film plane; however, this method is not suitable for attaching to the human body surface to generate electricity. In order to make the film generator more suitable for thermoelectric generation, it is necessary to apply a flexible heatsink on the air sides with the film to maintain the temperature difference. In this paper, Bismuth telluride thermoelectric paste was deposited on polyimide flexible substrate by a screen printing method, and the flexible thermoelectric film was formed after drying. There are ten pairs of thermoelectric legs. The size of the thermoelectric leg is 20 x 2 x 0.1 mm, and adjacent thermoelectric legs are spaced 2 mm apart. A phase change material-based flexible heatsink was designed and fabricated. The flexible heatsink consists of n-octadecane, polystyrene, and expanded graphite. N-octadecane was used as the thermal storage material, polystyrene as the supporting material, and expanded graphite as the thermally conductive additive. The thickness of the flexible phase change material-based heatsink is 2mm. A thermoelectric performance testing platform was built, and its output performance was tested. The results show that the system can generate an open-circuit output voltage of 3.89 mV at a temperature difference of 10K, which is higher than the generator without a heatsink. Therefore, the flexible heatsink can increase the temperature difference between the two ends of the film and improve the output performance of the flexible film generator. This result promotes the application of the film thermoelectric generator in collecting human heat for power generation.

Keywords : flexible thermoelectric generator, screen printing, PCM, flexible heatsink
Conference Title : ICTE 2021 : International Conference on Thermoelectrics
Conference Location : Dubai, United Arab Emirates
Conference Dates : March 22-23, 2021