Micro-pin-fin: A Uniform Temperature Heat Sink

Allali, Itamar

The purpose of this experiment was to test whether the use of a micro-pin-fin heat sink to cool Concentrator Photovoltaics produces a significantly more uniform temperature distribution than the use of a micro-channel heat sink. A heating resistor was used to simulate the Concentrator Photovoltaics. The resistor was attached to the micro-pin-fin heat sink, through which water was streamed. Above, an Infrared Radiometer took constant thermal images and made temperatures measurements. The software of the radiometer also made statistical standard deviation measurements of the temperature along the resistor. The heat sink's performance was tested with four different flow rates of water, each tested while achieving three different average resistor temperatures. Through the use of previously accepted theoretical models of heat sink behavior, analogous calculations were made to represent the micro-channel heat sink. The standard deviation of these calculations was calculated to compare with the experimental results. The standard deviations of the experimental data for the micro-pin-fin heat sink and the theoretical data for the micro-channel heat sink were compared by use of an F-test. The test concluded that the two standard deviations were significantly different. This means that the micro-pin-fin heat sink produced a significantly more uniform temperature distribution than the micro-channel heat sink would, making it more useful in cooling Concentrator Photovoltaics.

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