IX Minsk International Seminar "Heat Pipes, Heat Pumps, Refrigerators, Power Sources",
Minsk, Belarus, September 07–10 September, 2015

EXPERIMENTAL CHARACTERIZATION OF A DOUBLE BACKTOBACK PULSATING HEAT PIPE FOR POWER ELECTRONICS

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Abstract

The experimental characterization of a 104 turns pulsating heat pipe (PHP) cooler using R245fa and based on automotive heat exchanger technology for power electronics thermal management is presented in this article. The effects of fluid filling ratio, orientation and heat load up to 5.75 kW per PHP were investigated. Thermal resistances as low as 8.5 K/kW were measured at 2000 m^3/h air flow. However, a thermal resistance increase of 19 and 25 % was measured in horizontal and inverted orientations respectively. Periodic pressure peaks were measured, but with different amplitudes depending on the orientation. The condenser was found to be subcooled at all fillings and all orientationswhile the evaporator was very close to the saturation temperature. There was superheating measured at the evaporator manifold only at very low fluid fillings. There was a minimum in thermal resistance located between 40% and 50% fluid filling, for all tested orientations and heat loads. The maximal thermal resistance depended very little on the heat load. For a given set of operating conditions, a high frequency combined with low amplitude pressure peaksyielded better cooling performances.