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Superfluid helium heat pipe

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This paper reports on the development and the thermal tests of three super fluid helium heat pipes. Two of them are designed to get large transport capacity (4 mW at 1.7 K), they feature a copper braid located inside a 6 mm outer diameter stainless tube fitted with copper ends for mechanical anchoring. The other heat pipe has no copper braid and is designed to get much smaller heat transport capacity and to explore lower temperature (0.7 K –1 K). The copper braid and/or the tube wall is the support of the Rollin super fluid helium film in which the heat is transferred. The low filling pressure makes the technology very simple without the need for any external hot reservoir and with the possibility to easily bend the tube. We present the design and discuss the thermal performance of the heat pipes tested in 0.7 K –2.0 K temperature range. The long heat pipe (1.2 m with copper braid) and the short one (0.25 m with copper braid) have similar thermal performance in the range 1.7 K –2.0 K. At 1.7 K the long heat pipe, 120 g in weight, reaches a heat transfer capacity of 12 mW and a thermal conductance of 600 mW/K for 4 mW transferred power. Due to pressure drop of the vapour flow, the conductance of the third heat pipe dramatically decreases when the temperature decreases. A 3.8 mW/K is obtained at 0.7 K for 0.1 mW transferred power.

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