

Hydrogen gas gap heat switch working in 150-400 K temperature range

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A gas gap heat switch (GGHS) is a device that enables to toggle between two distinct thermal conducting states, offering the possibility to establish a good or a poor thermal contact between two parts of a cryogenic system without any moving pieces. The ON (high conductance) and OFF (low conductance) states of the switch are obtained by varying the gas pressure between two exchange surfaces separated by a narrow gap. This pressure is controlled by acting upon the temperature of a small sorption pump connected to the gap space. We designed and evaluated a prototype of a compact GGHS that uses hydrogen as exchange gas to work in the temperature range of 150 K to 400 K. In this temperature region, hydrogen is the best conducting gas and can be absorbed/desorbed with metal hydrides. For the working temperature range targeted, ZrMn₂ seemed to be a good solution. The GGHS sorb pump was filled with 2.6 mg of homemade ZrMn₂ and characterized on a cryocooler. Its thermal conductance was measured as function of pressure and compared with expected results. The switching between ON/OFF states was successfully achieved by heating or cooling the sorb pump. An ON/OFF ratio higher than 100 was obtained.