Washington University in St. Louis
Office of Technology Management

PASSIVE AND COMPACT LIQUID METAL HEAT SWITCH

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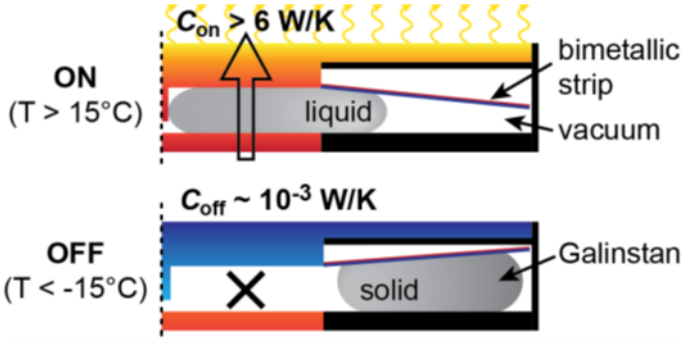
Technology Description

Researchers in Patricia Weisensee's lab at Washington University have developed a compact liquid metal heat switch with a passive mechanism to control the thermal management system of spacecraft. Unlike other switch mechanisms, the liquid metal version produces high conductance ratios (>150:1) while remaining compact and functions within an appropriate temperature range for space travel. The addition of a bimetallic strip in the switching channel produces a fully passive mechanism without any electromagnetic components.



Liquid metal heat switch with a conductance ratio > 150:1

Heat switches are an essential part of a spacecraft's thermal management system, manipulating the flow of heat between a warm source and a cold sink. Vehicles experience extreme variations in temperature (-180 to 130°C daily on the moon), and the function of electronics, instrumentation, and humans onboard depends on the systems managing those fluctuations.

Stage of Research

The inventors have constructed and tested a proof-of-concept switch with a 9 cm channel that uses a gallium-indium-tin alloy. Ongoing work surrounds the optimization of the bimetallic strip that provides the passive actuation mechanism.

Publications

- Passive and compact liquid metal heat switch. *NASA, 2019.*
- Weisensee to develop heat transfer switch for NASA. *The Source*, 2019.

Applications

- Manned or unmanned spacecraft thermal management system
- Battery thermal management requiring stable temperatures

Key Advantages

- High conductance ratios of >150:1
- Does not require active input
- Compact
- Scalable at room temperature

Patents: Pending

Related Web Links: Weisensee Profile & Lab