Oregon State University

Auburn University

Pumpless System for Two-Phase Cooling of High Powered Electronics

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Reference: Pumpless Cooling

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Overview

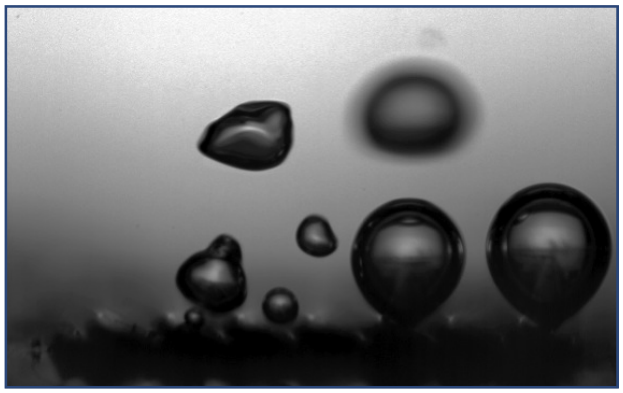
Auburn University and Oregon State University are seeking a licensee or development partner for a technology related to improved electronics cooling. Components, such as microprocessors, generate heat which needs to be removed to keep the device operational. Current methods use flowing air or liquid, with liquid typically performing better. However, today's electronic devices have ever increasing power density requirements, and associated increased heat generation challenges. Two phase heat transfer, wherein liquids are turned to vapor in the course of removing heat, demonstrate better thermal performance. But they can be limited by high pumping power requirements due to pressure drop constraints. Other power-free systems (such as heat pipes) cannot dissipate heat as effectively. The concept of the invention deals with a self-propelling two-phase flow of fluid that combines the high rate of heat transfer associated with boiling while removing pumping and power requirements. This technology is expected to find use with personal computers, servers, laptops, and a variety of other electronics products.

Advantages

- Presents flux thermal management system that is passive and compact
- Designed to be noiseless and self-regulating
- There are no pumps or other moving parts, enabling superior reliability
- Can be used in adverse orientations, expanding potential applications

Description

The thermally-actuated pumping mechanism seeks to simultaneously achieve high heat transfer rates while remaining power-free. This is accomplished by means of surface asymmetry paired with controlled nucleation to alter the bubble dynamics and create a pumping effect, thus achieving a pumpless flow. The surface asymmetry is created using gray-scale photolithography to create a large array of miniature saw-tooth ratchets. These are accompanied by re-entrant cavities used to control the bubble life cycle. The experiments conducted indicate significant potential for the concept of closed loop, self-pumping fluids for electronics cooling applications.



Status

- A patent application has been filed
- Proof of concept demonstrated on silicon platform with water as a model fluid (see video)

Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing
- Joint development opportunities include funded research or a joint venture
- Similar Technology: Improved Microchannel Design for Cooling of High Powered Electronics