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# High Performance Heat Sink with Counter Flow Diverging Microchannels

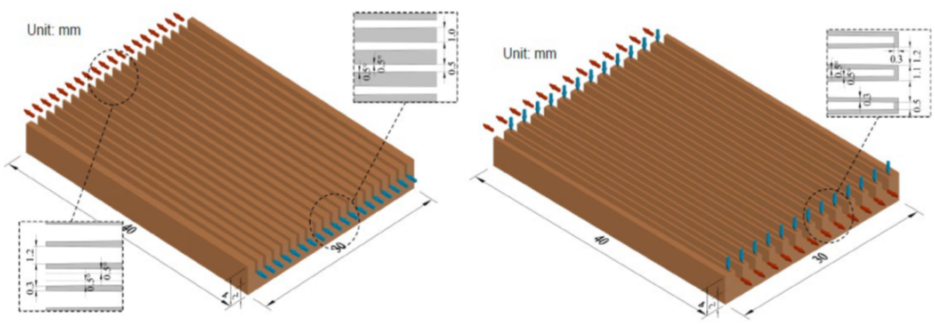
Energy & Environment

Manufacturing

Electricity and Power Electronics

Energy Conservation/Generation/Management/Storage (Battery)

Smart Mobility and Electric Vehicle




(a) (b)

Layout of the microchannel heat sinks: (a) Co-current Flow Diverging Microchannels (CCDM); (b) Counter Flow Diverging Microchannels (CFDM).

**IP Status**
Patent filed

Technology Readiness Level (TRL) 4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## Opportunity

Efficient heat dissipation is one of the technology challenges for the battery thermal management of electric vehicle as well as the miniaturization of integrated electronic circuits. Among different thermal management solutions, two-phase flow boiling in microchannels has been recognized as a useful approach for high density heat dissipation. However, to date, two-phase flow in microchannels is not commonly used due to various problems associated with their operation. Some of these problems include low critical heat flux (CHF) caused by premature dry-out, poor temperature uniformity along the microchannels, and instable flow caused by violent coolant phase transition.

## Technology

The present technology provides a high-performance heat sink with counter flow, and optionally diverging, microchannels to enhance the flow boiling performance. The invented microchannel heat-sink for high-power applications can be made easily and at low cost. Moreover, a unique and significant heat exchange between neighbouring microchannels dramatically alters the flow pattern transition in the counter-flow microchannels. It makes the heat sink with significantly higher heat transfer coefficient, critical heat flux, more uniform temperature distribution, stable two-phase flow, and lower pressure drop. Overall, with the excellent flow boiling performance and very high coefficient of performance, the technology offers a highly promising microchannel design for a variety of applications requiring high heat flux dissipation.

## Advantages

- High critical heat flux and even temperature distribution for large heating area;
- Low pressure drop for circulation and less flow instability under high heat flux condition;
- Effective configuration based on the lateral heat exchange between neighboring channels by the counter flow design;
- Simple and low cost of fabrication for mass production.

## Applications

- Battery thermal management, such as electric vehicle;
- Cooling system for high power electronics.