Clean Technology

Multi-Mode Liquid Cooling System for Electronics, Including Computers

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WARF: P05107US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a means to efficiently remove heat from electronics, while avoiding potentially damaging dry-out conditions.

Overview

To remove the substantial heat generated by today's most powerful microprocessors, many high-performance and personal computers use liquid cooling, rather than air cooling, technology. Research indicates that liquid cooling involving single-phase (non-boiling) heat transfer achieves the highest heat removal rates. This is because the coolant stays in contact with hot surfaces at all times, rather than boiling away and creating dry, super-heated spots that resist rewetting. To transfer heat effectively, however, single-phase systems require a greater volume of coolant than two-phase systems in which evaporation and boiling occur.

The Invention

By mixing together liquid coolants of different volatilities and boiling points, UW-Madison researchers have devised a means to efficiently remove heat from electronics, while avoiding potentially damaging dry-out conditions. In this system, a more volatile coolant of lower boiling point begins to evaporate as it flows over the hot surface. This phase change from liquid to vapor removes heat much more efficiently than can be achieved through simple heating of the liquid. At the same time, a less volatile component in the mixture remains liquid. This keeps the surfaces of electronic circuitry wet at all times, preventing dry-out and associated temperature fluctuations.

Applications

- Cooling high-performance and personal computers

Key Benefits

- Achieves higher rates of heat removal with less fluid flow, allowing use of smaller pumps and heat exchangers than do current liquid cooling systems
- Offers more uniform heat transfer over large areas
- Eliminates large, potentially damaging temperature fluctuations caused by dry-out, because liquid stays in contact with hot surfaces at all times
- To avoid the low-performance temperature gradients that often form when coolant mixtures are used, this system uses spray cooling technologies that keep cooling fluids well mixed.

Additional Information

Related Technologies

- See WARF reference number P04140US for the researchers' earlier liquid spray-cooling technology, which uses fan-shaped, rather than cone-shaped, sprays to enhance cooling performance.

Tech Fields

- Clean Technology : Energy storage, delivery & resource efficiencies
- Information Technology : Hardware

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842