Micro-Pump Is Cool Idea for Future Computer Chips

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Newswise — Engineers at Purdue University have developed a tiny "micro-pump" cooling device small enough to fit on a computer chip that circulates coolant through channels etched into the chip.

Innovative cooling systems will be needed for future computer chips that will generate more heat than current technology, and this extra heating could damage electronic devices or hinder performance, said Suresh Garimella, a professor of mechanical engineering.

The new device has been integrated onto a silicon chip that is about 1 centimeter square, or roughly one-sixth of a square inch. The technology is an example of a microelectromechanical system, or MEMS, a tiny mechanical device fabricated using methods generally associated with microelectronics.

"Because it's a MEMS pump, we were able to integrate the entire cooling system right onto a chip," Garimella said. "The most innovative part of the technology is the micro-pump."

An article about the cooling device will appear in the May issue of *Electronics Cooling* magazine. The article was written by doctoral student Brian D. Iverson, Garimella and former doctoral student Vishal Singhal, who recently graduated and co-founded Thorrn Micro Technologies Inc., in Redwood City, Calif.

Chips in today's computers are cooled primarily with an assembly containing conventional fans and "heat sinks," or metal plates containing fins to dissipate heat. But because chips a decade from now will likely contain upwards of 100 times more transistors and other devices, they will generate far more heat than chips currently in use, Garimella said.

"Our goal is to develop advanced cooling systems that are self-contained on chips and are capable of handling the more extreme heating in future chips," said Garimella, director of Purdue's Cooling Technologies Research Center. The center, supported by the National Science Foundation, industry and Purdue, was formed to help corporations develop miniature cooling technologies for a wide range of applications, from electronics and computers to telecommunications and advanced aircraft.

The prototype chip contains numerous water-filled micro-channels, grooves about 100 microns wide, or about the width of a human hair. The channels are covered with a series of hundreds of electrodes, electronic devices that receive varying voltage pulses in such a way that a traveling electric field is created in each channel. The traveling field creates ions, or electrically charged atoms and molecules,

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Contact Information

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Description

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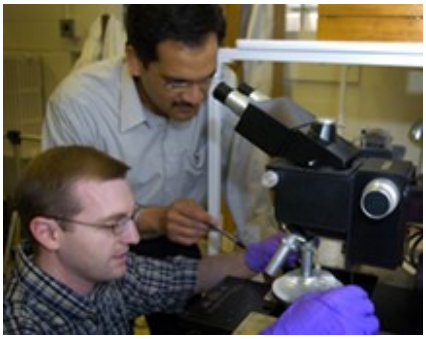

Purdue News Service photo/David Umberger

Purdue's Brian D. Iverson, from left, a mechanical engineering doctoral student, and mechanical engineering professor Suresh Garimella use a microscope to examine a disk containing "micro-pump" cooling devices small enough to fit on a computer chip. The tiny pumps circulate water through channels etched into the chip. The technology is an example of a microelectromechanical system, or MEMS, a tiny mechanical device fabricated using methods generally associated with microelectronics. Such innovative cooling systems will be needed for future computer chips because they will generate more heat, which could damage devices or hinder performance.