Nanotubes Act as 'Thermal Velcro' to Reduce Computer-Chip Heating

Released: 5/2/2006 3:05 PM EDT
Source: Purdue University

Newswise — Engineers have created carpets made of tiny cylinders called carbon nanotubes to enhance the flow of heat at a critical point where computer chips connect to cooling devices called heat sinks, promising to help keep future chips from overheating.

Researchers are trying to develop new types of "thermal interface materials" that conduct heat more efficiently than conventional materials, improving overall performance and helping to meet cooling needs of future chips that will produce more heat than current microprocessors. The materials, which are sandwiched between silicon chips and the metal heat sinks, fill gaps and irregularities between the chip and metal surfaces to enhance heat flow between the two.

Purdue University researchers have made several new thermal interface materials with carbon nanotubes, including a Velcro-like nanocarpet.

"The bottom line is the performance that we see with nanotubes is significantly better than comparable state-of-the-art commercial materials," said Timothy Fisher, an associate professor of mechanical engineering who is leading the research. "Carbon nanotubes have excellent heat-conduction properties, and our ability to fabricate them in a controlled manner has been instrumental in realizing this application."

Recent findings have shown that the nanotube-based interfaces can conduct several times more heat than conventional thermal interface materials at the same temperatures. The nanocarpet, called a "carbon nanotube array thermal interface," can be attached to both the chip and heat sink surfaces.

"We say it's like Velcro because it creates an interwoven mesh of fibers when both sides of the interface are coated with nanotubes," Fisher said. "We don't mean that it creates a strong mechanical bond, but the two pieces come together in such a way that they facilitate heat flow, becoming the thermal equivalent of Velcro. In some cases, using a combination of nanotube material and traditional interface materials also shows a strong synergistic effect."

Findings related to the combination of carbon nanotubes and traditional interface materials are detailed in a paper appearing in the May issue of the *International Journal of Heat and Mass Transfer*. The paper was written by mechanical engineering doctoral student Jun Xu and Fisher.

Libraries: Science

Keywords: Nanotechnology, Computer Chips, Electronics Cooling, Nanotubes, Thermal Interface Material

Contact Information

Available for logged-in reporters only

Description

Engineers have created carpets made of tiny cylinders called carbon nanotubes to enhance the flow of heat at a critical point where computer chips connect to cooling devices called heat sinks, promising to help keep future chips from overheating.