Nanostructured eTEC™ Seamlessly Embeds Into Applications for Heating, Cooling and Power Generation Requirements

Miniature thin film eTEC™ enables active, solid state temperature control…

Research Triangle Park, N.C. (June 26, 2007) – Nextreme has developed a miniature thin film embedded thermoelectric cooler (eTEC™) to address thermal management needs of the electronics, photonics, bio-tech and defense/aerospace industries. Manufactured using semiconductor processing techniques, the advanced solid state eTEC provides high-power densities and microsecond response times in an ultra-small footprint — as small as 0.3mm x 0.3mm x 0.1mm.

"Unlike conventional thermoelectric components made by manually assembling individual pellets together, we utilize semiconductor processing techniques to provide pin-point thermal control for high heat fluxes in order to increase product performance, reliability and yield," said Dr. Seri Lee, Chief Technology Officer at Nextreme.

Nextreme's unique eTECs offer an industry first — the seamless embedding of an active cooling and/or heating device in close proximity to the die of an integrated circuit. The eTEC structure optimizes thermal and electronic transport for enhanced thermoelectric performance by operating as miniature heat pumps; for rapid cooling or heating semiconductors and other electronics; for thermal management of fiber-optic laser controls and integrated optoelectronics; or for power generation by converting waste heat into electricity to increase efficiency in thermal batteries and automotive energy management.

Nextreme's eTECs are designed utilizing thin films that are small, thin, fast, efficient and reliable, adding just 100 microns of height to a heat spreader, enabling unobtrusive integration close to the heat source. The eTEC's ultra-fast, millisecond response time rapidly cools or heats to maintain a precise temperature depending on the needs of the application. The device pumps a maximum heat flux of 150W/cm^2 with some designs delivering as much as 400W/cm^2 versus less than 10 - 20W/cm^2 for typical bulk TECs. Nextreme's eTECs can operate in a high COP (Coefficient of Performance) regime and still pump a reasonably high heat flux (50 - 100W/cm^2). COP is a measure of efficiency defined as cooling power divided by input power. To cool a 4W hot spot, an eTEC with a COP of 2.0 would only need 2W of input power. The input power can be dynamically controlled to provide active cooling.

The eTEC operates by the Peltier effect: when an electric current is driven through a circuit containing two dissimilar materials, heat is absorbed at one junction — the cold side — and released at the other junction — the hot side. The eTEC is designed with thin film compound semiconductor materials that have high electrical conductivity and poor thermal conductivity to maximize current flow and minimize heat flowing back from the hot side to the cold side.

For more information, or to request an eTEC prototype, contact Nextreme at 3040 Cornwallis Road, P.O. Box 13981, Research Triangle Park, NC 27709-3981; call (919) 990-8300; e-mail info@nextreme.com; or go to www.nextreme.com.

About Nextreme

Nextreme manufactures thin film thermoelectric components that address most challenging thermal management and power generation needs of the semiconductor, photonics, consumer, and defense/aerospace industries. Nextreme's miniature, thin film eTEC offers an industry first — a micro-refrigerator the size of a piece of confetti that enables solid state temperature control or power generation on a micro-scale, in close proximity to the source. eTECs operate as point-specific heat pumps for rapid cooling or heating of semiconductors and other electronics; for thermal management of fiber-optic laser controls integrated optoelectronics; or for power generation by converting otherwise wasted heat into useful electricity.