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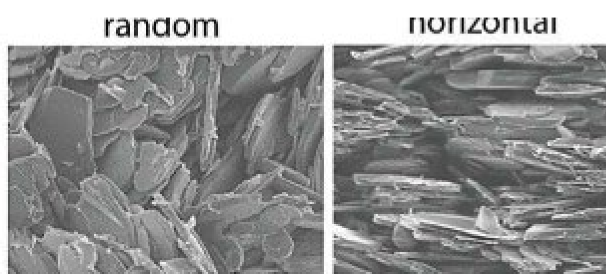
Chinese translation

Research offers solutions to keep high-powered devices cool

3D stacked electronics made from interconnected vertical chip layers are the next generation of energy-efficient, high-performance devices. However, 3D devices can easily overheat because dense components prevent heat from dissipating. One solution is to use heat-dissipating materials, such as hexagonal boron nitride (BN), to keep devices cool.



A team of scientists led by Nanyang Assistant Professor Hortense Le Ferrand, Nanyang Technological University's School of Mechanical and Aerospace Engineering, used magnetic fields to align and orient microscopic particles of BN, which can direct heat away from the source to prevent overheating. The study "Microstructured BN composites with internally engineered highly thermally conductive paths for 3D electronic packaging" can be found in Advanced Materials.

The researchers first coated boron nitride particles with iron oxide to make them respond to magnetic fields. They then suspended the coated particles in a solvent and used magnetic fields to align the particles in different directions.

Scientists tested the heat dissipation capabilities of different structures and found that vertically arranged particles conduct heat upwards most effectively. The orientation of the particles can also be adjusted to direct heat sideways, such as when the particles are sandwiched between two heat-generating electronic components.

Assistant Professor Le Ferrand said: "Our method of precisely and easily arranging and orienting BN particles to strategically direct heat dissipation may provide new solutions for effective thermal management of high-power electronic devices."