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How magnetic fields can prevent overheating in high-power electronic devices

Do you know how your phone or computer sometimes gets hot when you use it a lot? Imagine if it got so hot that it stopped working!

This is a big worry for scientists who are making new, super-powerful electronic devices that are even tinier than what we use today.

They're stacked up like a tower of electronic building blocks, and they're really good at doing lots of tasks super quickly. But there's a downside: they can get really hot, really fast.

The heating problem

These tiny towers of electronic chips are called "3D-stacked electronics." They're amazing because they can do a lot while using less energy.

But, because everything is so tightly packed, the heat they produce doesn't have much room to escape.

It's like having a bunch of people in a small room all breathing out hot air, but nobody opening a window!

A cool solution

So, what can be done to keep things cool? A group of smart scientists led by Assistant Professor Hortense Le Ferrand at Nanyang Technological University have found an answer. They used a special material called hexagonal boron nitride (BN for short) that helps to pull heat away from the electronic chips, keeping them cool.

How Does It Work?

First, they took tiny particles of this BN material and coated them with iron oxide. This special coating made the particles react to magnetic fields. Next, they mixed these particles in a liquid and used magnets to line them up in certain ways.

By doing this, they could control where the heat would go. For example, if they wanted the heat to move up and out of the device, they'd line the particles up vertically. But if they needed the heat to move sideways—maybe because there were other hot components nearby—they could arrange the particles that way too.

The scientists tested different setups to see how good they were at getting rid of heat. And guess what? The vertically lined-up particles were the best at channeling the heat upwards. But they also learned that they could direct the heat in other directions when needed.

Why is this cool (pun intended)?

This is a big deal because it could help us build even more powerful electronics without worrying about them getting fried from the heat.

Assistant Professor Le Ferrand said, “Our method of lining up BN particles to guide heat away offers new solutions for keeping high-power gadgets cool.”

The research team’s findings are super promising, and they’re looking into more ways to improve this cooling method. Their study is published in a fancy science journal called Advanced Materials if you want to learn more.

So, the next time you’re playing an intense game on your phone or binge-watching your favorite show on your laptop, just think about the amazing science that’s working to keep your gadgets cool.

And who knows, maybe one day your devices will use this magnetic trick to stay cool as a cucumber!

The study can be found in Advanced Materials.

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