Antiferromagnetism: A miracle material that can replace silicon in the field of memory chips

Memory chips made from antiferromagnetic materials will have a greater transistor density and are immune to the data loss magnetic effects of silicon chips.

Silicon is the second most abundant element in the Earth's crust (after oxygen), it is cheap and capable of conducting electricity and/or can act as an insulator. When converted into silicon wafers, it contributes to the computers, smartphones and other electronic devices we use every day.

Obviously, silicon is an indispensable material at the present time. We wouldn't be able to enter the Digital Age without silicon.

But our growing need for data creation and storage is pushing silicon to the limits of both speed, density, and security. In an effort to find a worthy alternative to silicon-based memory chips, MIT physicists turned to a new material called Antiferromagnetism.

"Antiferromagnetic materials (AFMs) are little-known cousins ??of ferromagnets or common magnetic materials. As the electrons in the ferromagnet rotate synchronously - the property that allows the compass needle to always point in the direction North, according to the Earth's magnetism - the electrons in antiferromagnetism like to rotate in opposition to each other. So the magnetism is effectively quenched even at the smallest levels," said researcher Jennifer Chu of the University of North Carolina. shared by MIT.

"Since there is no pure magnetism in an antimagnetic magnet, it does not absorb any external magnetic fields. If used to make memory chips, the antimagnetic bits can protect data to they are unaffected, erased by

magnetism.Also, antimagnetic materials also pave the way for the fabrication of smaller transistors and packing a larger number of transistors per chip than silicon. ".

For businesses that need to store a lot of data, it's magical to be able to store more data on their devices.

"The AFM chip allows for the expansion of the storage capacity of existing devices, which share the same capacity but can hold more data," said Riccardo Comin, assistant professor of physics at MIT and author of the study. shared AFM materials research.

However, AFT memory chips also have their own limitations and disadvantages. "It takes a lot of power every time to read or write data to the AFM chip," said Jiarui Li, one of the researchers. "When everything becomes very small, the electricity and heat generated by the electric currents are very significant."

The MIT team has also had success experimenting with more efficient AFM switching implementations. Switching is the process by which data is written to transistors that can be switched on and off to identify a stored photograph or other digital file. In particular, they can also add other substances to AFM to enhance the advantages and eliminate the disadvantages.

> "This research may offer the opportunity to develop an AFM memory chip that works similarly to a silicon chip but stores data more securely, with higher density," added Comin. "This is the key to solving the challenges of a developed, data-driven world."

Maybe the smartphone or computer that you buy in the future will not use AFM memory chips, but the needs of the digital economy force us to find ways to reduce our dependence on silicon, replace silicon .