

Adding carbon gives iron-platinum nanocrystals the ideal optical properties for heat-assisted magnetic recording

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Credit: AI-generated image ([disclaimer](#))

The disk drive in a computer works by using a magnetic field to change the physical properties of a tiny volume of a magnetically susceptible material. Current research aims to develop novel materials and technologies that can maximize storage capacity by focusing data into

the smallest possible volume.

Now, Zhanhong Cen and co-workers at the A*STAR Data Storage Institute in Singapore have experimentally and theoretically investigated the properties of iron–platinum (FePt) nanocrystals for use in ultrahigh-density magnetic recording media. They show that, as well as having the appropriate magnetic characteristics, the optical response of FePt is suitable for high-performance data-storage applications and that the use of pulses of laser light improves the magnetic recording process.

"Decreasing the size of magnetic particles makes the magnetic information become thermally unstable due to an effect called superparamagnetism," explains Cen. "FePt [nanoparticles](#) are very promising, because for these nanoparticles, superparamagnetism is suppressed at room temperature."

But FePt nanoparticles also have a drawback—the [magnetic field](#) required for writing data is much higher than that produced by present disk drives. While the magnetic-field intensity necessary for a change of state could potentially be reduced by locally heating the material with a pulse of light—a process called heat-assisted magnetic recording, little was known about the optical response of FePt until now.

Cen and the team created thin-film samples using a process known as sputtering, which involves firing a beam of particles at a FePt alloy to release iron and platinum atoms. The atoms land on a glass substrate covered with a layer of magnesium oxide where they form crystals. The team sputtered carbon at the same time to form a single layer of FePt nanocrystals 15 nanometers in diameter and 9.1 nanometers tall embedded in a film of carbon.

For comparison, the team also created a nanocrystal sample without carbon and probed the refractive index and absorption of the two

samples with both visible and near-infrared light. The researchers used these values in a computer model to simulate the performance of the material in a heat-assisted [magnetic recording](#) device. The sample doped with carbon came out on top.

"Our simulations show that introducing carbon into a FePt nanocomposite can improve optical performance," says Cen.

"Ultimately, a FePt–carbon recording medium will perform better than current storage options, because it will use a smaller optical spot on the recording media and enable more energy-efficient writing and reading of data."

More information: Cen, Z. H., Xu, B. X., Hu, J. F., Li, J. M., Cher, K. M. et al. "Optical property study of FePt-C nanocomposite thin film for heat-assisted magnetic recording." *Optics Express* 21, 9906–9914 (2013) [dx.doi.org/10.1364/OE.21.009906](https://doi.org/10.1364/OE.21.009906)

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