AI-generated nanomaterial images fool even experts, study shows
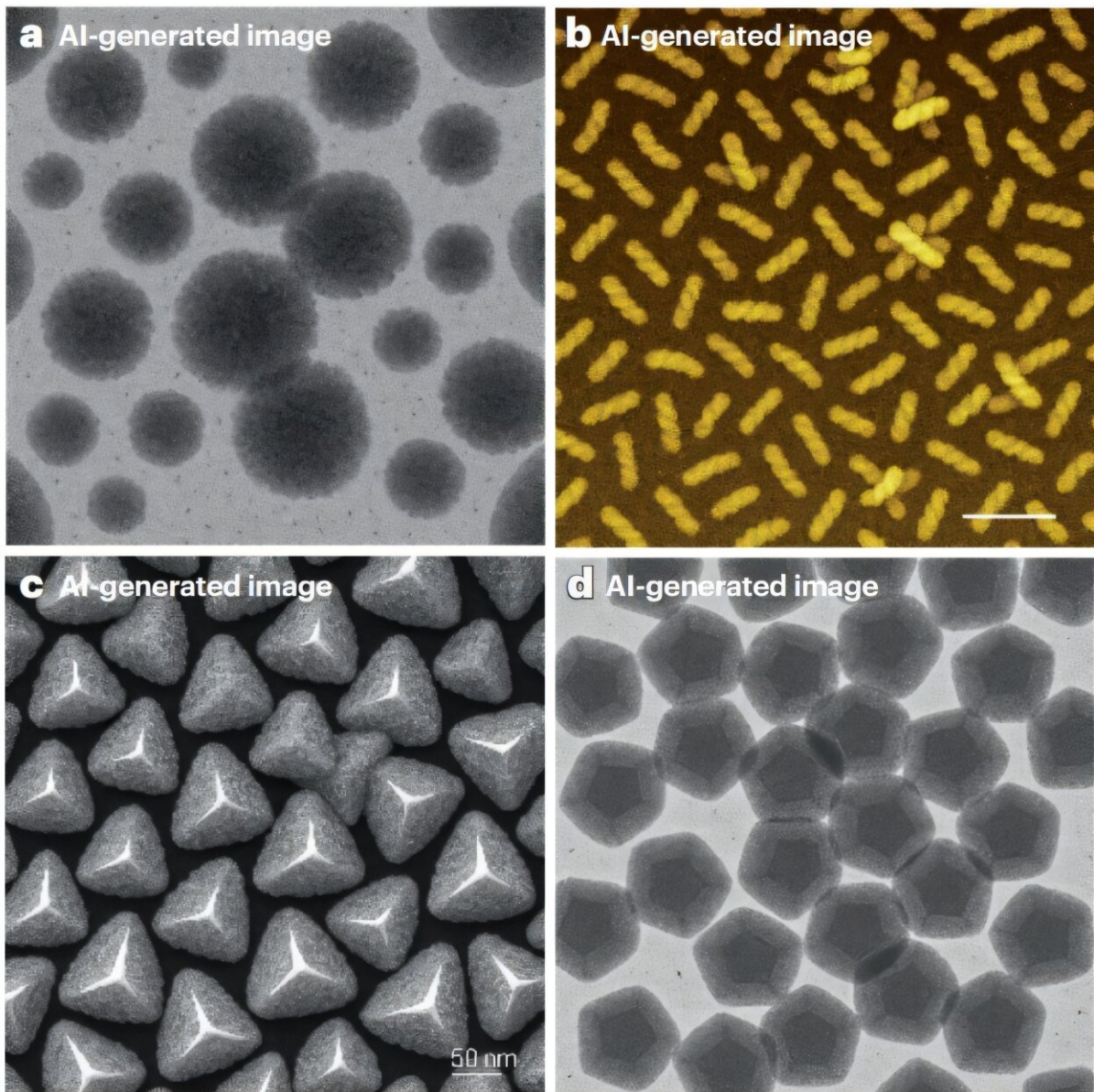
October 2 2025, by Sanjukta Mondal

Black-and-white images of pom-pom–like clusters, semi-translucent fields of tiny dark gray stars on a pale background, and countless other abstract patterns are a familiar sight in scientific papers describing the shapes and properties of newly engineered materials.

So, when research images show particles that resemble puffed popcorn or perfectly smooth "Tic Tacs," it might not trigger our AI suspicion radar, but researchers in a recent study caution otherwise.

Microscopy images are indispensable in nanomaterials science, as they reveal the hidden intricacies and fascinating shapes that tiny particles assume, which appear to be a pile of dust to the naked eye.

Scientists fear that generative AI is diluting the significance of these images by polluting the pool with fake, AI-generated photos that are indistinguishable from the real ones. Even seasoned researchers are finding it increasingly difficult to distinguish between real microscopy images of nanomaterials and those created by AI.

In the study, published in *Nature Nanotechnology*, experts were able to correctly identify real versus fake images only 40–51% of the time across four of six image pairs, showing no significant difference in their ability to detect them.

Researchers from five different nations joined forces to design a study that examined the threat of AI-generated fake microscopy images in nanomaterials science, demonstrating how the blurring of what's real and what's manufactured threatens the foundation of scientific integrity.

Using authentic microscopy data, they trained the image generation platform getimg.ai for less than an hour and produced fake images that closely resembled experimental results. These included six different microscopy techniques, such as transmission electron microscopy (TEM), atomic force microscopy (AFM), and scanning transmission electron microscopy (STEM), among others.
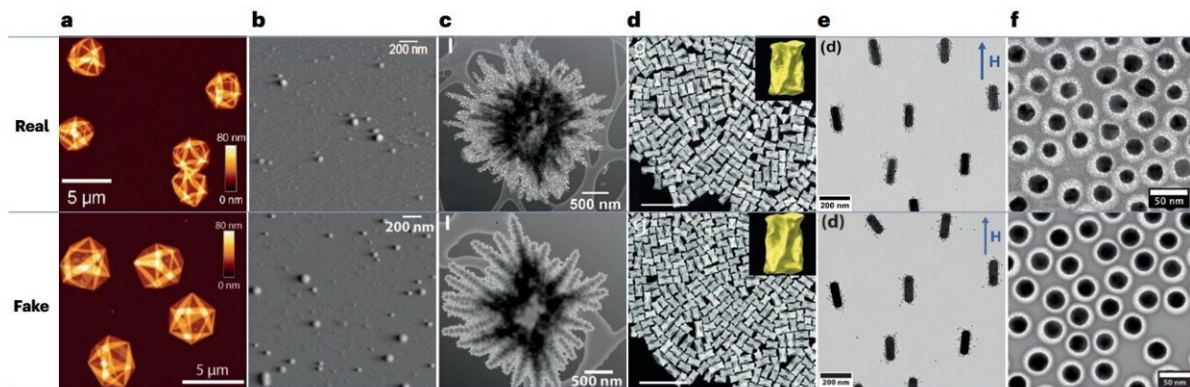
In a survey of 250 scientists, most could not reliably distinguish real from AI-generated nanomaterial images. Credit: *Nat. Nanotechnol.* (2025). DOI: 10.1038/s41565-025-02009-9

To test how convincing these images were, the team conducted an anonymous survey of more than 250 scientists. Each participant was presented with either the authentic or the AI-generated version of the images and asked to decide whether it was real, fake, or if they were unsure. When it came to telling real from fake, their expertise was accurate only half the time.

The researchers note that this pattern adds another layer of complication to an already tangled publishing ecosystem, undermining the reliability

of peer review and public confidence in nanoscience.

To overcome this issue, they encouraged the use of a simplified data storage structure called the Minimal Arrangement of Instrument Files (MAIF) approach, where each manuscript would have one main folder with subfolders for each figure, and each subfolder would contain the original instrument files for that figure.
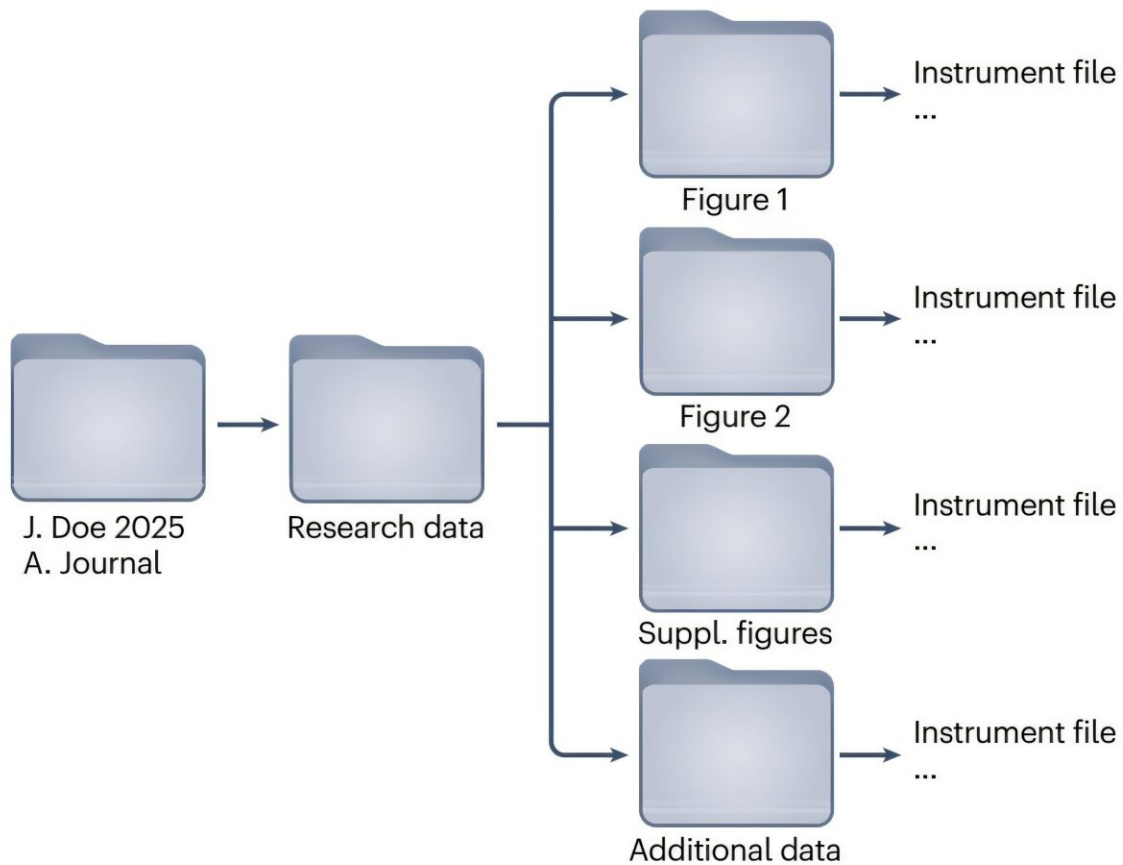
The MAIF storage principle. Credit: *Nat. Nanotechnol.* (2025). DOI: 10.1038/s41565-025-02009-9

The team acknowledges that AI's capabilities are sobering, as traditional methods of detecting fakes are failing while AI continues to improve. However, framing it solely as a threat to scientific integrity shouldn't be the end of the road.

Instead of viewing AI solely as a danger, the authors call for transparent and forward-thinking dialogue throughout the nanomaterials community.

Recognizing both the risks and the potentials can empower the scientific community to set clear standards and safeguards.