New Nanocrystalline Diamond Probes Overcome Wear

Researchers at the McCormick School of Engineering and Applied Science at Northwestern University, USA, have developed, characterized, and modeled a new kind of probe used in atomic force microscopy (AFM), which images, measures, and manipulates matter at the nanoscale.

Using diamond, researchers made a much more durable probe than the commercially available silicon nitride probes, which are typically used in AFM to gather information from a material, but can wear down after several uses.

Horacio Espinosa, James and Nancy Farley Professor of Manufacturing and Entrepreneurship, and his graduate student Ravi Agrawal have shown that diamond atomic force microscopy probes are 10 times more durable than silicon nitride probes.

"It is well-known that diamond should perform much better than other probe materials," says Espinosa. "However, rigorous quantification of wear and the development of models with predictive capabilities have remained elusive. It was exciting to discover that diamond probes are an order of magnitude more wear resistant than silicon nitride probes and that a single model can predict wear for both materials."

In the study, wear tests were performed using AFM probes made from different materials silicon nitride, ultrananocrystalline diamond (UNCD) and nitrogen-doped UNCD by scanning them across a hard UNCD substrate.

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