Nanotechnologists Discover How Diamonds Bend When Turned Into Ultrafine Needles

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Diamonds are among the strongest natural materials on earth, but scientists recently discovered it can actually bend when turned into ultrafine needle-like shapes.

A team of researchers from MIT and universities in Hong Kong, Singapore, and Korea noted that when diamonds are transformed into "extremely tiny, needle-like shapes", they stretch like rubber before transforming back to its original form.

Transforming Diamond Applications

The researchers said their findings present opportunities in a number of diamond-related processes such as sensing, data storage, and drug delivery, among others.

"We developed a unique nanomechanical approach to precisely control and quantify the ultralarge elastic strain distributed in the nanodiamond samples," said Yang Lu, coauthor and an associate professor of mechanical and biomedical engineering at the Chinese University of Hong Kong.

The authors explained that a process called elastic strain engineering could alter the mechanical and reactive properties of diamond, allowing it to become flexible.

The process started by creating diamond needles through chemical vapor deposition. The resulting diamonds were etched to their final shape on a silicon surface. Afterward, the needle-like diamonds were pressed down and bent while researchers observed through a scanning electron microscope.

The experiment, followed by a number of simulations, is intended to measure the diamond's tensile strength or the amount of strain it can handle before its breaking point.

"The controlled bending deformation also enables precise control and on-the-fly alterations of the maximum strain in the nano-needle below its fracture limit," said Dao Ming, a coauthor from MIT.
Measuring Tensile Strain
Using a computer model, the scientists measured that the maximum tensile strain of the needle was as high as 9 percent.

"When elastic strains exceed 1 percent, significant material property changes are expected through quantum mechanical calculations," said Yonggang Huang, a professor of civil and environmental engineering and mechanical engineering at Northwestern University.

The study was published on April 20 in the journal Science.

Uses Of Diamonds
Aside from jewelry, diamonds are used in a variety of fields including medicine, dental industry, cosmetics, computers, and industrial application. A study conducted by researchers at the South Wales College, Cardiff University found that tiny diamond particles a thousand times smaller than human hair can help treat cancer.

Diamonds are also attached in dental drills used to clean cavities. The physical properties of diamonds make the drills particularly abrasive. In cosmetics, certain beauty products contain ingredients from diamonds that act as an exfoliator and anti-aging agents.

Because diamonds have high resistance to heat, research has shown that semiconductors built using diamonds make computers faster, lighter, and more efficient.