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Office of Naval Research Funds Diamond Coating Science

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Armed with more than $3 million from the Department of Defense Office of Naval Research, research engineers from two Midwestern universities have begun probing the scientific riddle underlying a little understood diamond-coating technology.

Since receiving the three-year grant in March 2005, the six-person team from the University of Nebraska, Lincoln (UNL), and the University of Missouri, Rolla (UMR), have begun probing why the use of overlapping pulsed lasers to deposit thin coatings of diamond and diamond-like carbon surfaces is considered effective.

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"If we can understand the science of the phenomenon and the principles behind it, we can use the coating technology with other materials besides diamonds," said Yongfeng Lu, UNL Associate Professor of Engineering. The multi-laser beam process being studied reportedly makes surfaces stronger, lighter, and more resistant to corrosion, abrasion, and humidity.

QQC, Inc., headquartered in Dearborn, Michigan, developed the original technology in the mid-1990s. At QQC researchers tried vaporizing a thin layer of steel using overlapping light pulses from three types of high-powered lasers—eximer, yttrium-aluminum-garnet, and carbon dioxide (CO_2), UNL officials reported. This process created an electrically charged, superheated plasma of coating element that bonded to the surface of glass, plastic, or metals.

Under the DoD grant, the UNL-UMR team plans to customize the QQC coating technique using three laser systems: a resonance absorption laser, an ultraviolet (UV) laser, and a controlled plasma cooling and coating formation laser, explained Robert Schwartz, a UMR Materials Science and Engineering Professor. By establishing the physics behind the coating technique, Schwartz and his colleagues hope to determine how to use it to coat surgical tools, auto bodies, ships, airplanes, or even golf clubs.

The team will conduct theoretical testing using computer models and experimental testing with laser facilities at each of the universities, Schwartz said. "The process will replace other chemical vapor deposition and physical vapor deposition techniques, such as sputtering or pulsed laser ablation," he concluded.

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