New polymer-coating process developed

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As gas prices continue to soar, the Navy will be eager to learn of research underway at Rutgers University--Camden. "Barnacles that attach to naval ships are a huge cost to the Navy. Imagine if you drove a car with a parachute attached; this extra drag force requires more gas," says Daniel Bubb, an assistant professor of physics at Rutgers-Camden, who has developed a new method for coating polymers.

Used in a variety of industries, including protecting battleships from freeloading barnacles, polymers are materials made from long chains of molecules.

Thanks to a $129,463 National Science Foundation grant in its third year, Bubb and his team (including a post-doctoral fellow, undergraduate, and graduate students) are refining this new coating process. By employing a pulsed laser deposition technique, a high-power laser is focused onto a target material in a vacuum chamber, creating a plume of vaporized material. The object that is to be coated is placed in the path of the vapor. The Rutgers-Camden research team then tunes the laser to a specific vibrational mode of the polymer to ease the vaporization process and limit photochemical and photothermal damage.

This research will benefit many industries that rely solely on the most commonly used method of spin-coating, a viable technique for certain applications but inefficient for coating devices that are too large or small for its apparatus.

"With spin-coating, it's difficult to layer and adhesion can be a problem"

says Bubb, whose research also could improve biocompatibility in devices that require coating only on very specific and sensitive areas.

The Rutgers-Camden researcher also has advanced coating polymers that are too thermally sensitive by treating materials with a solvent before using the laser. This aspect of the research is funded through a $35,000 Cottrell College Science Award.

This past summer undergraduate Elijah Brookes of Haddonfield and post-baccalaureate student Brian Collins of Voorhees joined Bubb on visits to Vanderbilt University, where the Rutgers-Camden research team tested their findings at the W.M. Keck Vanderbilt Free-electron Laser Center.

Bubb's team establishes preliminary findings on the four lasers housed at Bubb's lab at Rutgers-Camden – three are solid state laser systems, the fourth laser allows the group to tune to specific vibrational bands in the material they study. While the free-electron laser at Vanderbilt provides exceptional power and wavelength range for the Rutgers-Camden student research team to more definitively pin down their data.

"Working with Dr. Bubb has allowed me to get involved in the physics department and see how it is to really work in a lab setting. My experience will surely benefit me as I graduate," says Brookes, a junior physics major at Rutgers-Camden.

"We don't limit our conversations to strictly laser optics. So, if I have a question on any branch of physics or any branch of science even, Dr. Bubb is there to answer. That's been amazing to me," says Collins, who is currently applying to medical school.

Source: Rutgers, the State University of New Jersey