Researchers awarded patent for hydrophobic, corrosion-resistant coating

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Sergiu M. Gorun, PhD, is an associate professor of chemistry at New Jersey Institute of Technology. Credit: New Jersey Institute of Technology

Sergiu M. Gorun, PhD, associate professor of chemistry at New Jersey Institute of Technology (NJIT), was awarded a patent today for a novel composition of matter. "Functional Coating Compositions of Perfluoroalkyl Perfluoro-Phthalocyanine Compounds" (US Patent Number 7,670,684) discloses a new self-contained subclass of molecules. These new materials are comprised of organic scaffolds with metal centers, which can be applied as either an opaque or transparent hydrophobic coating.

"A combination of properties has been achieved based on the presence of a metal in the molecular structure without compromising the desired

robust, hydrophobic features," Gorun said. "Consequently, these coatings are more versatile than previous materials since most metals can be incorporated." The new composition avoids exposing humans to the cancerous effects of heated petroleum-based products, which may make the new compositions more environmentally acceptable than current well-known coatings. Since all carbon-hydrogen bonds have been eliminated and replaced by perfluorinated carbon chains or fluorine, the new molecules exhibit a high thermal stability as compared to petroleum-derived materials.

The coatings work by maintaining a low-energy surface that resembles a lotus leaf in its property to repel water, despite the presence of metal centers. Since water does not wet the surface, any exposed area covered by the coating will not be subject to water binding, thus preventing the onset of corrosion.

This new chemical configuration also mitigates the destructive effect of oxygen, the culprit that ages organic materials. The absence of any carbon-hydrogen bonds in NJIT's new coating removes the pathway for oxygen to destroy the new molecules.

Interestingly, the use of certain metals in the center of the composition enables the coatings to use the sun's radiation for the photo-physical activation of oxygen from air. Activated or singlet oxygen is good for maintaining a clean surface. It won't destroy the robust coating, thus contributing to its overall protective effects.

The potential applications for these new materials are broad. US Army researchers are interested in these coatings for military and commercial applications: preventing the corrosion of vehicles and related hardware as well as applying the coatings to surfaces as a self-cleaning repellent for chemical and biological contaminants.

On-going collaborative research is focused on using the materials as biocidal coatings for medical instruments or hospital walls or as an optical coating that allows surfaces to change color under the influence of electrical currents. One industrial application includes the photocatalytic oxygenation of molecules.

Provided by New Jersey Institute of Technology