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Self-healing Automotive Paint is No "Urban Legend," Thanks to USM's Urban Research Group

By Angie Godwin

Shopping buggy dings and rock chips beware. You may no longer be an annoyance, or worse, an added expense. With a little help from Mississippi's polymer scientists, we may simply drive down the road on a sunny day, enjoying a little road therapy, while our cars' paint repairs their own scratches. No, self-healing car paint is not an "urban legend." University of Southern Mississippi (USM) polymer science and engineering professor, Marek Urban, Ph.D., and his research group, the Urban Research Group, have developed a polymeric coating that does just that – heals itself.

The automotive industry represents only one area of the Urban Research Group's research applications. Currently, the strategy of the group is "the development of new generations of stimuli-responsive polymeric materials that exhibit self-repairing attributes or are capable of autonomous responses," explained Urban. "We are basically trying to create polymeric materials that mimic Mother Nature."

So, what do you get when you cross a ring and a shrimp on a sunny day? Self-healing paint. Yes, really. With worldwide media coverage, including feature articles in *Forbes*, *The New York Times*, *National Geographic*, *New Scientist* and *Science*, this research brings together a host of somewhat unlikely "partners in crime" (or chemistry, that is). With co-author Biswajit Ghosh, also at USM, Urban mixed a ring-shaped

chemical, oxetane, and chitosan into polyurethane. Plentiful and available at very little cost, chitosan is derived from chitin, the primary component of the exoskeletons of shrimp, lobster and other crustaceans. The research was initially funded through a grant from the Mississippi Department of Marine Resources to explore uses for the enormous volumes of shrimp casings that the Gulf Coast seafood industry must find ways in which to dispose.

Dr. Marek Urban

"The oxetane splits when, in this case, the automotive coating surface is scratched," Urban said. "It cross-links with the chitosan when triggered by ultraviolet light. Sunlight works perfectly as the trigger. The scratch heals itself in about 30 minutes."

In the March 2009 *New York Times* article, "A Polymer Coating That Can Heal Itself Thanks to UV Light," author Henry Fountain suggested, "If your car picks up a scratch at the parking garage, for instance, it might disappear by the time you arrive home." The potential to reduce the sheer irritation of a dinged car, as well as the cost of ownership, improves the possibility of adoption and integration of the polymer coating into automotive manufacturing.

After the news of this development was released in 2009, Urban and his research team did not stop there. "We are constantly trying to create advanced materials that are responsive and adaptable," he added. "We keep our minds open for innovation."

For the automotive industry, this tenacity is especially important. In the Oliver Wyman study, "Car Innovations 2015," industry leaders and strategists target innovation as the driver in the future stability and growth of the automotive industry. In a sector where stagnation means regression, those interviewed for the study agreed that innovation was "one of the most important factors to maintaining a strong competitive position in the auto market." The study maintains that vital to "auto industry recovery and growth, is innovation."

Innovation attracts more innovation. Innovators tend to actively seek out other innovators. In fact, about 60 polymer scientists and engineers will gather in Hattiesburg at USM this fall to discuss stimuli-responsive materials for the 7th annual International Symposium on Stimuli-Responsive Materials. The speakers list forms a global footprint, representing academic and industry researchers from around the world. During the symposium, Mississippi will host an intensive dialogue on cutting-edge research and innovation in advanced materials. Some of these may even serve as the catalyst for new products and applications in the automotive industry.

Presently, the Urban Research Group is exploring anti-corrosive properties of stimuli-responsive materials. A closer look at automotive paint shows a wealth of opportunities to integrate these materials into each layer of vehicle coatings: electrocoat, primer, basecoat and clearcoat. For example, the anti-corrosive properties are applied at the electrocoat level. Corrosion remains a troublesome enemy of the automotive industry and reducing corrosion will extend a vehicle's life, enhance its appearance and reduce the cost of ownership. Continued work on primer encourages research on adhesive properties, which forms tighter bonds between the electrocoats and the basecoat, again improving the durability of vehicle. In addition, color responsiveness promises to add value to these polymer materials. The coating would change colors when scratched, and then return to its original coloration after the UV light exposure and subsequent healing.

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Urban emphasized that stimuli-responsive materials add value, promise and even greater economic rewards. With possibilities virtually endless, he brainstormed about energy-saving, human-comfort values such as vehicles with roof coatings that turn white in the summer and black in the winter, reflecting and capturing heat respectively. Or, cars fueled by solar energy collected from their own paint and converted into energy, then fuel. "We have a passion," he said, "a true desire to create stimuli-responsive materials, materials mimicking nature that, in a non-invasive way, will benefit people."

What wakes him up in the middle of the night? "An idea. A new and exciting idea," he admitted. "A new innovation that we dream about today and create tomorrow."

Who is the beneficiary of these dreams, passions, spirit of innovation and quests for excellence? The State of Mississippi is as a whole – and specifically, its automotive industry sector; but more importantly, the global marketplace benefits. ■

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