Sustainable, Self-Healing Coatings (2013-065)

Inhibits corrosion and extends life of self-healing materials, reducing environmental footprint

Market Overview

This self-healing polymer coating inhibits corrosion of metal iron substrates while extending the life of coated materials. Self-healing materials are an emerging and promising market, expected to reach a market value of $2.7 billion by 2020. The concept of self-healing materials is to enable materials to repair damage with minimum intervention. Current approaches to achieving self-healing materials are based on encapsulating self-healing agents, which is an expensive and oftentimes impractical endeavor. Clemson University researchers have developed a self-healable polymeric coating that is achieved via crosslinking sugar moieties capable of self-repair and incorporating in polyurethanes. Further, the corrosion inhibition is achieved by crosslinking materials that inhibit the formation of iron containing oxides. By using this newly developed protective coating, the life of equipment or products can be significantly extended and their environmental footprint reduced.

Application

Sustainable coatings

Stage of Development

Preliminary Prototype

Advantages

- Extends life of coated materials, reducing environmental footprint
- Enables self-healing and corrosion inhibition, fulfilling attributes existing materials lack
- Allows for simple, scalable manufacturing process, minimizing costs compared to previous self-healing approaches

Technical Summary

Clemson researchers have developed self-healable polyurethane polymeric coatings and simultaneous corrosion inhibition when applied to metal iron substrates. Self-healing is achieved via crosslinking of chitosan with polyurethane forming components. Corrosion inhibition is achieved by crosslinking of dopamine with polyurethane as terminating chain and segments that inhibits formation of Fe+3 containing oxides. By incorporating sugar moieties into polyurethanes, these materials are able to react with atmospheric CO_2 in the presence of H_2O, thus reforming covalent linkages capable of bridging cleaved network segments. Mechanical properties are recovered during self-repair process. These materials resemble behavior of plants during photosynthesis, but unlike plants, they don't require photo-initiated reactions.

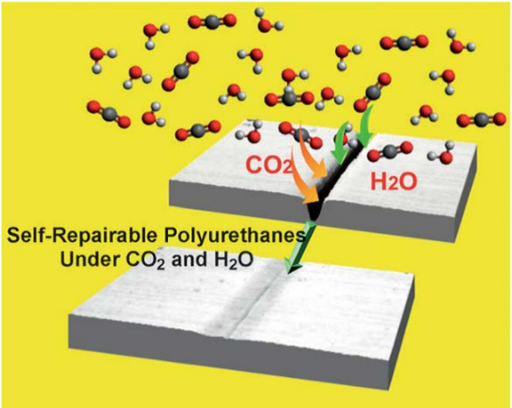
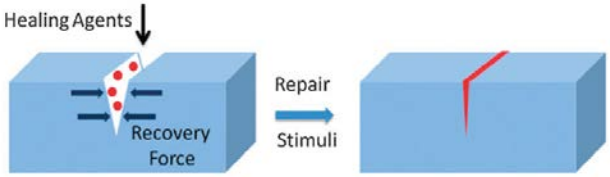


Figure 1: Self-Repairable Polyurethane Networks by Atmospheric Carbon Dioxide and Water



App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Utility	United States	15/037,214	NA	2013-065	Marek Urban, Ying Yang

About the Inventor

Dr. Marek Urban is the J.E. Sirrine Foundation Endowed Chair and Professor in the Department of Materials Science and Engineering. He earned his Ph.D. in Chemistry and Chemical Engineering Department from Michigan Technological University. Prior to joining Clemson University, Marek directed the Industry/University Cooperative Research (I/UCRC) and Materials Research Science and Engineering Centers (MRSEC) funded by the National Science Foundation. He also served as department chair at North Dakota State University and director of School of Polymers and High Performance Materials at the University of Southern Mississippi. He's published over 350 research papers and hold several patents. His research interests focus on self-healing polymers, stimuli-responsive nanomaterials, and surface and interfacial polymer science.

For More Information

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