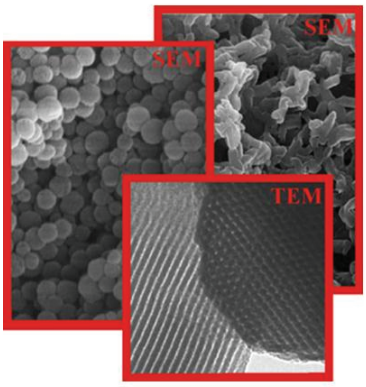
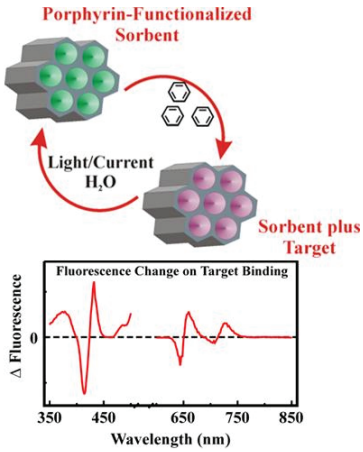
Naval Research Laboratory

The Corporate Laboratory for the Navy and Marine Corps

Catalytic Self-Decontaminating Materials

The Naval Research Laboratory Center for Biomolecular Science and Engineering is making materials that capture entire classes of contaminants. The materials hold on to contaminants, like typical carbon materials would, and then convert them into something harmless. The technology is stable and can be used for clothing or even coated on windows and vehicles. Wet or dry, the materials are effective in mid-summer heat. The laboratory scientists, at a lab-scale, have bonded the chemical materials to fabrics and powders to verify their potential for military or commercial applications. The research complemented efforts by the Defense Threat Reduction Agency to think beyond just clothes.





The materials are made out of self-decontaminating structures based on porphyrin-embedded, target imprinted, porous, organosilicate sorbents. The materials rapidly sequester targets as a result of the affinity of the sorbent structures. Catalysis proceeds upon stimulation of the porphyrin moieties through illumination or by an applied current. This potential for dual stimulation provides the opportunity for utilization of the materials in sunlit or low light environments. Catalysis in aqueous solution and under ambient conditions in the absence of liquid water has been demonstrated. Target selectivity can be controlled through selection of porphyrin and sorbent characteristics. The spectrophotometric characteristics of the porphyrin catalytic component also offer the potential for self-reporting materials. Attachment of the materials to fabrics and surfaces has been demonstrated using standard techniques. Materials with activity against organophosphate pesticides, aromatic solvents, and nitroenergetics have been described.

Advantages

Rapid target sequestration, Stimulation of catalysis by electric current or illumination, Tunable selectivity, Multiple possible material formats, Resistance to temperatures of up to 150°C, Excellent chemical stability, Reusable / Regenerable

Opportunities

Catalytic surface coatings and fabrics, Chemical protective clothing, Self-decontaminating hardware, Catalytic membranes

Licensing and Collaboration Opportunities

US Patent No. 7,749,438, 7,754,145 and US Published Patent Application No. US 20140273688 are available for License to companies with commercial interest. Collaborative research and development is available under a Cooperative Research and Development Agreement (CRADA).

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