Biological Method for Detecting and Repairing Defects in Material Surfaces
Technology #10903

Applications

This is a method to detect and repair nanoscale defects (e.g., corrosion, cracks, threading dislocations) in surface coatings or materials. It can be applied for the detection of corrosion pits in steel surfaces throughout many industries including ore processing, oil wells and pipelines, and production plants.

Problem Addressed

The structural integrity of steel can be dramatically impacted by corrosion. As such, efforts are often taken during production to minimize the process (e.g., application of protective coatings). Corrosion pits are very small holes that develop in a metal (e.g., steel) as a result of oxidation. From the surface, they are extremely difficult to detect. Inside, however, they are capable of damaging the structural integrity of the metal by contributing to weak spots (e.g., fatigue cracks) that decrease the material's lifespan. Identifying corrosion pits early is key to preventing rapid structural degradation. This phage-based method to identify and repair nanoscale defects in surface materials ultimately enhances the quality control and inspection of metal samples, reducing future engineering failures and economic burden.

Technology

This is a method for the detection and repair of nanoscale surface defects in a material substrate. Pitting corrosion is a common hazard that penetrates holes into metal. It is difficult to detect due to the small diameter of the holes. In order to target these localized defects, this phage-based technology harnesses the binding specificity that is inherent to biological interactions. Biomolecules are able to differentiate individual molecules from thousands of competitors. Phage display, commonly used to identify peptides with specific substrate affinities, is used to select peptides that can bind these surface defects. Phage display is a screening system in which a peptide of interest is expressed as part of a coat protein on the surface of the phage. The phage will then bind to substrates for which the expressed peptide has an affinity. A phage library composed of millions of phage and associated peptides is used for the screen. The system is used to select phage that bind: 1) exclusively to defects, 2) exclusively to a repair material, and 3) to a tether that links (1) and (2). This provides a means to deliver a repair material to the identified defect and integrate it into the surface, conferring structural support and extending the lifespan of the material.

Advantages

- The rapid and non-destructive identification of defects also allows for repair
- Can be used to detect defects in a variety of materials and surface coatings
Categories For This Invention:

Materials
Metallurgy
Life Sciences
Biotechnology
Environment
Remediation
Sensing

Intellectual Property:

Biomolecular recognition of crystal defects
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Publications:

Biomolecular Recognition of Crystal Defects: A Diffuse Selection Approach
Advanced Materials
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External Links:

Biomolecular Materials Group
http://belcherlab.mit.edu/

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