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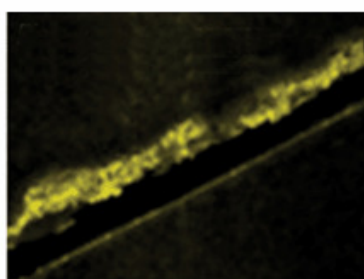
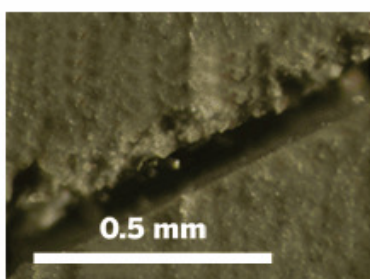
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Fluorescence Exposes Steel Corrosion

Epoxy coating that can alert inspectors to the need for maintenance

[Sophie L. Rovner](#)



Courtesy of Weihua Ming

RUST WARNING Corrosion along a scratch on steel coated with a “smart” epoxy is invisible under natural light (left). But the sites of corrosion fluoresce when excited by a laser (right). The left-hand image was taken with a conventional optical microscope, and the right-hand image was taken with a confocal microscope.

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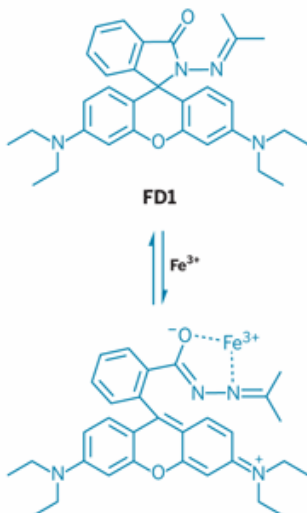
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FD1 fluoresces when it complexes with Fe³⁺ from corroding steel.

Steel is often coated with epoxy to protect the metal from corrosion. However, the coating can fail because of mechanical damage or prolonged exposure to the environment, permitting corrosion that can go undetected and lead to metal failure. By adding an indicator molecule, [Weihua \(Marshall\) Ming](#), [John G. Tsavalas](#), and Anita Augustyniak of the University of New Hampshire have developed the first “smart” epoxy coating that can alert inspectors to corrosion in underlying steel (*ACS Appl. Mater. Interfaces*, DOI: [10.1021/am900527s](#)). The indicator molecule, a spiroactam known as FD1, is nonfluorescent in the presence of undamaged steel. But when steel corrodes, it releases ferric ions that complex with FD1, thereby opening the spiroactam’s amide ring and making the molecule fluoresce when excited by a laser or ultraviolet light. The smart coating reveals corrosion and signals the need for corrective maintenance before any obvious sign of metal damage can be seen by the naked eye. Inspectors could check steel structures protected by such a coating with a handheld device, Ming says.