MXene-Based Long Period Fiber Grating Sensor with Fe-C coating for Corrosion Rate Measurement

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PROBLEM STATEMENT

Corrosion of reinforcing steel is one of the leading causes of failure in aging concrete structures, steel structures, and metal pipelines. The damage is costly and dangerous, especially in coastal areas and regions with heavy industrial pollution. Traditional electrochemical monitoring methods are affected by several factors such as electromagnetic interference, temperature, and humidity. Optical fiber sensors solve many of these problems, but the most sensitive versions rely on a graphene coating that is difficult to apply and produces inconsistent sensor performance.

SOLUTION

Researchers at Missouri University of Science and Technology developed a corrosion sensor built on a long-period fiber grating coated with MXene. The MXene layer replaces graphene as the conductive middle layer and is applied via simple dip coating after a piranha surface treatment. A thin Fe-C layer is then electroplated on top. As the Fe-C layer corrodes, the sensor tracks the corrosion via wavelength shifts in the transmission spectrum. Testing in saltwater showed a service life of 30 to 42 hours and a maximum wavelength shift of 7 to 15 nm. The corrosion process followed a clean two-stage pattern that fit a corrosion characteristic curve with an adjusted R-square of 0.9997.

VALUE PROPOSITION

The MXene coating greatly simplifies fabrication compared to graphene while keeping high sensitivity. It produces more uniform adhesion and more consistent sensor performance. The sensor is immune to electromagnetic interference, works in harsh environments, and can be embedded directly in reinforced concrete for corrosion monitoring.

Opportunity

Seeking a licensing and development partner to scale this corrosion sensor into manufacturing for civil infrastructure monitoring.

Development Stage

Validated in the lab.

Intellectual Property

Provisional
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