

## Intelligent response self-healing protective coating

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**Abstract:** Organic coatings lack durability in marine corrosive environments. Herein, we designed a self-healing coating with a novel nanofiber network filler for enhanced protection. Using electrospinning, we created a core-shell structure nanofiber network consisting of polyvinyl butyral (PVB) as the shell material and gallic acid (GA) and phenanthroline (Phen) as the core material. The PVB@GA-Phen nanofiber network, which includes synergistic corrosion inhibitors (GA-Phen), was embedded in an epoxy coating (PVB@GA-Phen/epoxy) and applied to carbon steel. Density functional theory (DFT) calculations and molecular dynamics (MD) simulations demonstrated that the GA-Phen combination, through hydrogen bond interaction, facilitated inhibitor adsorption on the steel surface. The GA-Phen combination diagnosed corrosion and formed a protective film on the scratched areas. The sustained release of Phen-GA combination inhibitors for up to 240 h resulted in an 88.63% healing efficiency of the PVB@GA-Phen/epoxy (PGP/EP) coating. The long-term corrosion resistance tests confirmed the effective barrier performance of the PGP/EP coating in 3.5 wt % NaCl solution. Moreover, the incorporation of the nanofiber network in the epoxy coating provided passive barrier, corrosion-diagnosing, and anticorrosion properties for carbon steel protection. The designed coating has the potential to continuously monitor the coating/metal system and could serve as a foundation for developing new anticorrosion coatings.

**Keywords:** corrosion inhibition; electrospun nanofibers; corrosion-diagnosing; self-healing; protective coating

### Reference

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