

Nacre-Inspired Metal-Organic Framework Coatings Reinforced by Multiscale Hierarchical Crosslinking for Integrated Antifouling and Anti-corrosion

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Abstract A long-standing quest in marine materials science has been the development of tough and effective antifouling coatings for diverse surface protection. However, most commercial coatings are severely limited by poor mechanical behavior and unsustainable passive biocidal effect, leading to irreversible marine biofouling and even microbiologically influenced corrosion (MIC). Herein, inspired by the amorphous/crystalline feature within nacreous platelets, we develop a mechanically robust antifouling coating composed of biopolymer-based hydrogel and dense metal-organic frameworks (MOFs). Tailoring the crosslinked networks across multiscale interfaces could furnish strength, dissipate strain, and improve toughness of the building blocks, resulting in a firm and scalable configuration on various substrates regardless of material category and surface topology. The resultant coating as a suitable reservoir exhibits a unique active defensive behavior of intelligent MOF degradation or drug release, enabling a groundbreaking performance for broad-spectrum biofouling and corrosion control. Notably, neither attachment of marine organisms nor MIC of metal substrates is observed and aggravated during the prolonged testing process in complex biological environments. This study should provide distinctive insights into the underlying multimechanisms of comprehensive anti-fouling-corrosion and pioneer a rational strategy to design next-generation reliable MOFs-derived coatings in marine environments.

Keywords Metal-Organic Framework Coatings, amorphous/crystalline heterophase structures, antifouling and anti-corrosion

Reference

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