MOFs as potential materials for anticorrosive conversion coatings

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Abstract In the realm of material engineering, functional coatings such as anti-corrosion coatings are vital for prolonging the lifespan and enhancing the performance of metallic substrates. Traditional coatings, including anodic oxidation and chromate conversion films, are often limited by environmental concerns and performance under diverse conditions. Recent research has pivoted towards exploring more sustainable and efficacious alternatives. Metal-organic frameworks (MOFs), known for their exceptional porosity and customizable structures, have emerged as promising candidates. However, the application of MOFs in the form of conversion coatings, especially on lightweight alloys, remains challenges in achieving optimal adhesion and integrated functionalities. This study investigates MOF-based conversion coatings for effective corrosion resistance and multifunctional performance, underscoring the need for innovative solutions in protective material science.

Herein, we explore the design and fabrication of MOF and MOF-derivative coatings on metallic substrates through *in-situ* methods aimed at achieving "smart" protective properties. Zn-based MOFs, specifically ZIF-8, are utilized to convert from ZnO nanorod arrays to study the growth dynamics and corrosion protection performance. Our methodology focused on enhancing the interfacial adhesion and loading capacity of the coatings while integrating multiple functionalities into the conversion films. The results indicate that these MOF-based coatings provide superior corrosion protection, corrosion sensing and durability on metallic substrates.

Keywords Metal-organic frameworks, conversion coating, corrosion protection