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Fabrication of Self-Healing Superhydrophobic Coatings on Steel as Effective Corrosion Barrier

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Abstract: *It has been demonstrated that silica-based coatings prepared using sol-gel technology are highly chemically stable and reduce metal corrosion, making them ideal for applications such as protecting metals in marine industries. Moreover, this technology offers an eco-friendly way to produce surface coatings, potentially replacing toxic pre-treatment coatings of traditional chromate. This study aims to produce superhydrophobic silica coatings to protect the steel substrate from corrosion. The approach includes a modification of base SiO_2 coating by 1H, 1H, 2H, 2H-perflurodecyltriethoxysilane (FAS) and its effect on wetting and corrosion resistive behavior of coatings. X-ray photoelectron spectroscopy (XPS) characterized the surface elemental composition of coatings. Water contact angle (WCA) and atomic force microscopy (AFM) are utilized to determine coatings' wetting behavior. The corrosion protection potentials of coatings were examined by potentiodynamic polarization curve (PDPC); all these are supported by surface morphology analysis using scanning electron microscopy(SEM). The results of PDPC show an increase in corrosion protection due to the modification of base silica coating by FAS. Additionally, modified coatings exhibited improved resistance to cracking and self-cleaning ability.*

Keywords: Superhydrophobic, Sol-gel method, Dip Coatings, Anticorrosive, self-cleaning

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