Core-shell Fluorine-silicon Modified Polyacrylic Coating for Corrosion Protection of 304 Stainless Steel Substrate

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A series of core-shell fluorine-silicon modified polyacrylic emulsion had been prepared by seeded emulsion polymerization. Methylmethacrylate (MMA), butyl acrylate (BA) and acrylic acid (AA) were used as the monomers of polyacrylic core. And the shell of the emulsion was modified by polyacrylic with dodecafluoroheptyl methacrylate (DFMA), vinyl triethoxysilane (VTEO) and tetraethyl orthosilicate (TEOS). The completed of reaction was proved by fourier transform infrared spectroscopies (FT-IR). TEM analysis indicated core-shell structure of the hybrid particles. The surface analysis indicated that the excessive addition of VTEO-TEOS had a negative effect for the film. Electrochemical Impedance Spectroscopy (EIS) indicated that the anti-corrosion of the film went up first and then down with the increase of VTEO-TEOS content. The best anti-corrosion content of VTEO-TEOS was 1.0% (F-1.0Si). In this, the corrosion current density of the coating had reached $3.7 \times 10^{-8} \text{ A} \cdot \text{cm}^{-2}$, the efficiency of anti-corrosion was 99.53%, the water contact angle was 99° and the thermal decomposition temperature was 298°C . Two glass transition temperature indicated that the emulsion was the structure of two phases with different properties. The high-efficiency anti-corrosion time of film within 300 h was showed with immersion experiment.

Keywords: Core-shell; Anti-corrosion; Stainless steel; Fluorine-silicon; Water diffusion

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