Enhancement of the Anticorrosion Properties of Epoxy Resin Composites through Incorporating Hydroxylated and Silanised Hexagonal Boron Nitride (h-BN)

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Hexagonal boron nitride (h-BN) has the outstanding properties of high-temperature stability, electrical insulation and impermeability against water, oxygen and corrosive ions. However, BN easily agglomerated in the coating, resulting in coating microporous defects and reducing the anticorrosive properties. Thus, h-BN was modified through a two-step treatment, hydroxylation and silanisation. h-BN modified by silane coupling agent 3-glycidoxypyrroltrimethoxysilane (KH560) was characterized by Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM). Then, the corrosion resistance of the BN-KH/epoxy resin coatings was measured by electrochemical testing. The results demonstrated that the corrosion current density of the coating with modified h-BN nanosheets was decreased from $2.67 \times 10^{-7} \text{ A} \cdot \text{cm}^{-2}$ to $5.28 \times 10^{-8} \text{ A} \cdot \text{cm}^{-2}$ compared with that of the pure epoxy resin. The impedance of the composite coating with modified h-BN is $5.27 \times 10^7 \Omega \cdot \text{cm}^2$, approximately 20 times higher than that of the coating with the original h-BN ($1.95 \times 10^6 \Omega \cdot \text{cm}^2$) and the EP coating ($4.26 \times 10^5 \Omega \cdot \text{cm}^2$), indicating that BN-KH can protect the coating from damaging corrosive ions and that BN-KH/EP can maintain an excellent anticorrosion property.

Keywords: hexagonal boron nitride; corrosion resistance; modified; electrochemical impedance spectroscopy

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