CHEMISTRY OF SURFACE AND THIN FILMS

TiO_2/epoxy composites as effective anticorrosion coatings for steel

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Epoxy resins are thermosetting polymers which have been widely used in different fields including anticorrosive protection [1]. Incorporation of nanoparticles in epoxy matrix can enhance corrosion resistance as well as improve optical, thermaland mechanical properties of the epoxy coatings [2]. Among different nanoparticles used as additives for epoxy resins, TiO_2 is the most perspective owing to unique properties, relative low cost and wide-spread application. The purpose of present work was to prepare TiO_2/epoxy coatings on steel and to study the influence of TiO_2 additive on anticorrosive properties of the coatings.

In the experiments, commercially available water-based epoxy resin CHS-Epoxy 200v55 and Telalite 180 amine hardener were used for preparation of the epoxy coatings. The TiO_2 particles were fabricated according to the method described in [3]. TiO_2/epoxy composite coatings with 0.5, 1 and 2 wt.% of TiO_2 were prepared by adding an appropriate amount of TiO_2 particles into the epoxy resin followed by mechanical dispersing and then addition of the curing agent. The obtained mixture was deposited onto steel plates using casting blade method.

The resultant cured coatings with a thickness of 60 ± 3 μm were partly transparent, non-porous and demonstrated excellent adhesion to steel surface. The distribution of TiO_2 particles in the cured epoxy matrix was studied by SEM and EDX mapping. In addition, RAMAN spectroscopy was applied for characterization of 3D distribution of titania particles in the coatings. TiO_2 particles were found to be rather uniformly distributed in epoxy network. The corrosion resistance of the epoxy coatings modified with TiO_2 nanopaticles was investigated by standard salt spray test. Unmodified epoxy coatings were failed with rust formation after 24 h. Incorporation of TiO_2particles into polymer matrix increased the corrosion resistance of the epoxy coating up to 96 h.

In conclusion, the epoxy coatings loaded with TiO_2 nanoparticles were deposited onto steel substrate by casting blade technique. The addition of TiO_2 to epoxy resin led to the enhance of anticorrosion performance of the coatings.

References

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