Effects of nanosilica and titanium oxide on the performance of epoxy–amine nanocoatings

Muvinkumar Parimalam[a], *Muhammad Remanul Islam*[b], *Rosli Mohd Yunus*[b]

[a] Section of Chemical Engineering Technology, Malaysian Institute of Chemical and Bioengineering Technology, University of Kualalumpur, Alor Gajah, Melaka, 78000, Malaysia
[b] Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Gambang, Pahang, 26300 Malaysia

ABSTRACT

Different types of composite coatings were prepared by the blending of colloidal nanosilica (SiO_2) and titanium dioxide (TiO_2) in epoxy resin to investigate their coating performances. A fixed amount of silica nanoparticles (20 wt %) and different amounts (5, 10, and 15 wt %) of microsized TiO_2 particles were used in the coatings. The functional groups of the formulated coatings were confirmed by Fourier transform infrared spectroscopy. These results indicate that the SiO_2–TiO_2 particles interacted well with epoxy. Scanning electron microscopy images of the composite coatings revealed a good dispersion of TiO_2 particles at a lower amount of loading; this improved the adhesiveness, glass-transition temperature, thermal stability, and chemical resistance properties. At higher loadings, the performances decreased. The composite coatings were also characterized by their UV radiation-absorption properties with an ultraviolet–visible spectrophotometer. Interestingly, this property was found to be enhanced at higher loadings. An impressive result was noticed in the nanocomposites in terms of oxygen transmission rate performance compared to that of the neat epoxy.

KEYWORDS

Coating performance; Colloidal nanosilica; Oxygen transmission rates; Radiation absorption; Resistance properties; Scanning electron microscopy image; Titanium dioxides (TiO2); Visible spectrophotometers

REFERENCES

1. Amit,C., Muhammad, S.I.
   (2008) *Mater. Sci. Eng.*, 487, p. 574.

2. Ghosh, P.K., Pathak, A., Goyat, M.S., Halder, S.
   Influence of nanoparticle weight fraction on morphology and thermal properties of epoxy/TiO2 nanocomposite
   (2012) *Journal of Reinforced Plastics and Composites*, 31 (17), pp. 1180-1188.

3. Xiaming, S., Tuan, A.N., Zhiyong, S., Yajun, L., Recep, A.
   (2009) *Surf. Coat. Technol.*, 204, p. 237.

4. Wei, H.W., Chih, C.C., Hui, C.
   (2005) *Compos. Interfaces*, 8, p. 631.

5. Huang, K.S., Nien, Y.H., Chen, J.S., Shieh, T.R., Chen, J.W.
   Synthesis and properties of epoxy/TiO_2 composite materials
   (2006) *Polymer Composites*, 27 (2), pp. 195-200.