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Assessment mechanical properties of epoxy clay nanocomposite coatings

Milad Edraki[1]
1. Young Research and Elite Club, South Tehran Branch, Islamic Azad University, Tehran, Iran
Edraki5228@yahoo.com

Abstract
Some new multipurpose additives for solvent based epoxy coatings were synthesized. The additives were characterized by FTIR spectrometry and X-ray diffraction (XRD). The additives synthesized by cationic exchange process of clay (montmorillonite) and some special protonated polyetheramines were used to develop some new epoxy systems. The introduction of new additives in epoxy systems resulted in improving mechanical properties (adhesion, Persoz hardness, elasticity of coating film), durability, gloss resistance and water resistance.

Keyword: layered silicate,epoxy,clay, ,mechanical properties

introduction

Epoxy has been widely used as a coating material to protect the steel reinforcement in concrete structures [1–3], because of its outstanding processability, excellent chemical resistance, good electrical insulating properties, and strong adhesion/affinity to heterogeneous materials.
Nonetheless, the successful application of epoxy coatings is often hampered by their susceptibility to damage by surface abrasion and wear [4,5]. They also show poor resistance to the initiation and propagation of cracks [6]. Such processes introduce localized defects in the coating and impair their appearance and mechanical strength. The defects can also act as pathways accelerating the ingress of water, oxygen and aggressive species onto the metallic substrate, resulting in its localized corrosion. Furthermore, being hydrophilic in nature, epoxy coatings experience large volume shrinkage upon curing and can absorb water from surroundings [7,8]. The pores in the cured epoxy coating can assist in the migration of absorbed water and other species to the epoxy–metal interface, leading to the initiation of corrosion of the metallic substrate and to the delamination of the coating.
The barrier performance of epoxy coatings can be enhanced by the incorporation of a second phase that is miscible with the epoxy polymer, by decreasing the porosity and zigzagging the diffusion path for deleterious species. For instance, inorganic filler particles at nanometer scale can be dispersed within the epoxy resin matrix to form an epoxy nanocomposite. The incorporation of nanoparticles into epoxy resins offers environmentally benign solutions to enhancing the integrity and durability of coatings, since the fine particles dispersed in coatings can fill cavities [9,11] and cause crack bridging, crack deflection and crack bowing [12].