



## Effects of Colloidal Nanosilica on Epoxy-based Nanocomposite Coatings

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### ARTICLE INFO

#### Article history:

Received: 12 Dec 2018

Final Revised: 9 Feb 2019

Accepted: 10 Feb 2019

Available online: 9 Mar 2019

#### Keywords:

Adhesives

Barrier

Blending

Coating

Composites.

### ABSTRACT

*Epoxy-based nanocomposites were fabricated with different content of colloidal silica nanoparticles such as 10.0, 20.0 and 30.0 wt %, through solution casting. The covalent bonding interfaces, resulting from a ring-opening reaction between silica nanoparticles and epoxy matrix were confirmed by the Fourier transform (FT-IR) infrared spectroscopy. These nanocomposites were characterized for thermal stability, glass transition temperature and adhesive properties using thermogravimetric analyzer (TGA), differential scanning calorimeter (DSC) and cross-cut tape test. In addition, chemical resistance was assessed by immersing the films in different chemical solution (acid, alkali and salt solution) for 21 days. It was found that the properties of the nanocomposites were increased proportionally to the content of silica nanoparticles up to a certain amount of loading. After that the properties were decreased. The surface morphology of the nanocomposites was observed by scanning electron microscopy (SEM), which showed that the silica nanoparticles distributed uniformly. In addition, the nanocomposites were studied on UV radiation absorption by UV-Vis spectrophotometer. Excellent UV radiation was noticed by the nanocomposite films. The oxygen transmission rate (OTR) and water contact angle (WCA) testing of the nanocomposite films was also impressive. Prog. Color Colorants Coat. 12 (2019), 71-82© Institute for Color Science and Technology.*

### 1. Introduction

Epoxy resin was discovered in 1909. It has been widely used as a coating material to protect a substrate from corrosion because of its good adhesive, strong bond strength, durability, toughness, formulation latitude and chemical resistance properties [1]. However, it shows poor coating properties on high-performance application due to some limitations, such as poor adhesive properties and chemical resistance properties

[2]. Research has been carried out to prepare epoxy composite by introducing traditional inorganic fillers in epoxy. It shows slight improvement in properties, but it cannot be applied in coating formulation due to phase separation problem which is the biggest disadvantage [2]. In recent years, nanotechnology has become popular in different numbers of application for extraordinary benefits. This technology has also been applied coating to improve the properties [3, 4]. This

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