Mechanical propereties and moisture absorption of epoxy composite mixed with amorphous and crystalline silica from rice husk

ABSTRACT

Thermosetting epoxies are low-density polymers with excellent adhesion, mechanical properties, and resistance to environmental degradation. They are widely used as molds and castings for manufacturing, protective coatings, and reinforcement material for aircraft. However, polymer brittleness is a major disadvantage preventing its widespread application. The addition of filler materials such as nanoparticles has attracted considerable attention. Using reinforcement materials for biocomposite derived from a natural, renewable and sustainable material will lower the manufacturing cost for epoxy composites. This study investigated the physical and mechanical properties of epoxy composites reinforced with amorphous and crystalline silica. The amorphous and crystalline silica were obtained by the precipitation method from the carbonization of rice husk at 700 °C and 1000 °C for 6 h, separately. The epoxy resin was mixed with 5 wt%, 10 wt%, and 15 wt% concentrations (by weight) of amorphous and crystalline silica, separately. Silica 10 nm to 30 nm in size was obtained, as observed by scanning electron microscopy (SEM). The epoxy nanocrystalline silica composite had a significantly lower thickness swelling value compared to the epoxy nano-amorphous silica composite. However, the epoxy nano-crystalline silica composite had significantly better mechanical properties.

Keyword: Composite; Epoxy; Nano-silica; Rice husk