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Amine Hardeners with Carbon Nanotubes Dispersing Ability for Epoxy Coating Systems

Authors : Szymon Kugler, Krzysztof Kowalczyk, Tadeusz Spychaj

Abstract : An addition of carbon nanotubes (CNT) can simultaneously improve many features of epoxy coatings, i.e. electrical, mechanical, functional and thermal. Unfortunately, this nanofiller negatively affects visual properties of the coatings, such as transparency and gloss. The main reason for the low visual performance of CNT-modified epoxy coatings is the lack of compatibility between CNT and popular amine curing agents, although epoxy resins based on bisphenol A are indisputable good CNT dispersants. This is a serious obstacle in utilization of the coatings in advanced applications, demanding both high transparency and electrical conductivity. The aim of performed investigations was to find amine curing agents exhibiting affinity for CNT, and ensuring good performance of epoxy coatings with them. Commercially available CNT was dispersed in epoxy resin, as well as in different aliphatic, cycloaliphatic and aromatic amines, using one of two dispergation methods: ultrasonic or mechanical. The CNT dispersions were subsequently used in the preparation of epoxy coating compositions and coatings on a transparent substrate. It was found that amine derivative of bio-based cardanol, as well as modified o-tolylbiguanide exhibit significant CNT, dispersing properties, resulting in improved transparent/electroconductive performance of epoxy coatings. In one of prepared coating systems just 0.025 wt.% (250 ppm) of CNT was enough to obtain coatings with semi conductive properties, 83% of transparency as well as perfect chemical resistance to methyl-ethyl ketone and improved thermal stability. Additionally, a theory of the influence of amine chemical structure on CNT dispersing properties was proposed.

Keywords : bio-based cardanol, carbon nanotubes, epoxy coatings, tolylbiguanide
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