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Synthesis of bio-based adipic acid-polyoxypropylene diamine copolymer and its synchronous enhancement of strength and fracture toughness on epoxy resin composites

Chunwang Yi
Hunan Normal University, China

Cured modified epoxy resins, as a typical thermoset resin, is widely applied in adhesives, electronic packaging, protective coatings, composites matrix for its outstanding performance in mechanical strength, insulation ability and corrosion resistance. However, epoxy resins prone to brittle facture at low temperature, which restricts it application in some special areas, like aerospace and automotive fields. In recent years, bio-based polyether was widely used to improve the toughness of epoxy resins. Howbeit, investigations revealed that when using long-chain polyether as modifier, though it has been proved to own outstanding toughness, while at the same time, it showed deficiencies in the impact strength and Young's modulus. In order to solve this problem, a new bio-based adipic acid-polyoxypropylene diamine copolymer with molecular weight of 2000 (AA-PPA 2000) has been synthesized by extending polyoxypropylene diamine D400 with adipic acid. The new bio-based polymer was used to modify diglycidyl ether of bisphenol A (DGEBA) epoxy/diethyl toluene diamine (DDM) system, and the polyoxypropylene diamine D2000 was taken as the reference. The results of low-field 1H-NMR, DMA and mechanical properties test revealed that at the same condition of adding content, PPA2000 was superior to D2000 in modifying epoxy resins and maintained better overall performance. Amazingly, the results also disclosed that by using PPA2000 as toughener, intermolecular hydrogen bonds had been formed between amide groups of PPA2000 and hydroxyl groups of epoxy resins, which led to more complicated networks taken shape in the epoxy composites and thus introduced distinct advantages to the composites at achieving the synchronous enhancement of strength and fracture toughness.

Biography

Chunwang Yi is a Senior engineer and Professor, serves for both University and industrial companies, has his expertise in improving the synthesis route of bio-based and functional polyamide polymer. He creates a successful green path in preparing functional copolymers based on PA6, bio-based polyether and so on. He has both in built this reputation after years of experience in research, teaching and service both in engineering company and education institutions.

cwyi@@hunnu.edu.cn

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