PREFACE

Hyperbranched polymer is one of the most interesting macromolecules in the domain of material science. It offers superior properties like viscosity, solubility, reactivity, compatibility, etc. compared to the linear analog of same molar mass. In case of epoxy thermoset, hyperbranched architecture exhibited better toughness, dimensional stability, adhesive strength, etc. compared to the same molar mass containing linear analog. Further, polymer nanotechnology has drawn tremendous attention in current research for the development of polymeric materials for their improvement of properties as well as increasing application area.

Thus, main objective of this thesis is to develop an epoxy thermoset with unique macromolecular architecture and subsequent attempt to enhance the spectrum of its application area by incorporating different types of nanomaterials. Therefore, a few hyperbranched epoxies were synthesized by combined effect of aromatic-aliphatic moieties and unique structural architecture to overcome the shortcomings like low toughness, high dielectric constant, non biodegradability, etc. of commercial epoxy thermosets. The study revealed that the nature and amount of branch generating moiety of the hyperbranched epoxy strongly influence the ultimate performance of the thermosets. Further, to fulfil the advanced demand of the epoxy thermoset different nanomaterials like modified clays, carbon dot and carbon dot reduced Cu_2O nanohybrids were incorporated into the synthesized hyperbranched epoxy resins. These hyperbranched epoxy nanocomposites have high potential to be used as high performing materials for structural, optoelectronics, antimicrobial, heterogeneous photocatalyst, etc. applications.

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