PREFACE

Polymer nanocomposites are explored for finding out apt options in the domain of smart materials. Amongst them, graphene based polymer nanocomposite is an emerging area to develop as graphene is a wonderful material of this era with various outstanding and unique properties. It may provide some exceptional properties in the resultant nanocomposite. However, graphene based hyperbranched polyurethane (HPU) nanocomposite is not explored satisfactorily, especially vegetable oil-based HPU nanocomposites are rare in literature. Therefore, the excellence of graphene together with vegetable oil-based HPU is yet to explore comprehensively. Again, mechanical, electrical and thermal properties of graphene based PU nanocomposite are mainly studied in most of the cases. Yet, different others applications such as shape memory behavior, self-healing and self-cleaning ability are not addressed fully. Thus, it opens a new direction of research to use graphene based HPU nanocomposites as shape memory, self-healing and self-cleaning polymeric materials.

Thus, the main objective of this thesis is to develop smart materials such as shape memory, self-healing, photo-induced self-cleaning materials by incorporating different types of graphene based nanomaterials. Incorporation of functionalized reduced graphene oxide (RGO) provides excellent multistimuli responsive shape memory behavior in the fabricated nanocomposite. Further, HPU nanocomposite with iron oxide nanoparticles decorated RGO nanohybrid showed repeatable and rapid self-healing ability under microwave and sunlight. Incorporation of sulfur nanoparticles decorated RGO nanohybrid provided profound antimicrobial attribute in the resulted nanocomposite. Again, HPU/TiO_2-RGO nanocomposite demonstrated sunlight-induced self-cleaning ability with multistimuli responsive shape memory and self-healing attributes. Thus, the studied HPU nanocomposites reflect their immense potential for different smart applications.

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