# Preface

Nanotechnology has proven to be a potential technology that is rapidly emerging in wider areas such as medicine, electronics and food technology by manipulating nanomaterials for various applications. Nanotechnology is the engineering and art of developing new materials on a nanoscale. A nanomaterial is defined as a discrete entity that has at least one of its dimension as 100 nm or less. It may include any of the following nano forms: nanoparticles, nanotubes, fullerenes, graphene, nanoclays, nanofibres, nanowhiskers and nanosheets to name a few. The applications of nanomaterials are quite broad. Due to their unique properties, the application of nanomaterials in various scientific fields, including environmental sciences, has increased greatly. It is well known that the performance of polymer materials can be greatly enhanced by dispersion of nanometre-size materials. Such materials are called polymer nanocomposites and have the interesting characteristic that the mechanical properties; the barrier properties; the thermal properties and some others such as flammability and water adsorption can be greatly enhanced with addition of a small amount of filler (usually less than 10 wt %).

Indeed, polymer nanocomposite (PNC) is a promising multidisciplinary research activity in the field of material research that might expand the utilization of polymers in various industrial applications. The use of polymers has been extended in different fields as PNC enhances the properties of polymer to obtain a product with essentially a new set of properties. It is expected that the transition from micro to nano materials increases the surface area-to-volume ratio. This in turn results in a prominent increment of the behaviour of the atoms on the surface of the nanomaterials. It affects the properties of the nanomaterials when they react with other nanomaterials. Due to the higher specific surface area of nanomaterials, interaction with other nanomaterials within the mixture becomes more intense. This consequently results in positive properties, such as high temperature capability, resistance against corrosion, noise damping, low in cost/manufacturer, ductile, high specific stiffness and strength high thermal conductivity, and low coefficient of thermal expansion. Another advantage of polymer nanocomposites is that it could be fabricated via rapid and precise manufacturing methods, such as injection molding, compression molding, vacuum bag molding, contact molding, and resin transfer

molding. Therefore, polymeric nanocomposites are speculated as appropriate options in overcoming the inherent restrictions of microcomposite and monolithic, while posing preparation challenges related to the control of elemental composition and stoichiometry in the nano-cluster phase.

Within the development of polymer nanocomposites, there are challenges and limitations. Today, mankind is aware of eco-friendliness that has led to growing attention in reducing environmental impact cause by traditional polymer nanocomposites. The rise in environmental awareness has further led governments to make more stringent regulations as well as researchers to explore new eco-friendly polymer nanocomposites. Such nanocomposites obtained by using eco-friendly materials and techniques as well as incorporating nanofillers to biopolymers, are extremely promising products because they provide better properties with conservation of the material biodegradability, environmental friendliness, easy processing, impressive physico-mechanical properties, avoiding eco-toxicity. This assists in evolution of simpler chemical processes or innovative designed product for future generations by the chemical industries that should create least environmental impact. An interest in naturally available renewable materials has been developed due to the global environmental concern. Numerous studies are underway on the preparation and applications of eco-friendly polymer nanocomposites.

Keeping in mind the immense advantages of eco-friendly polymer nanocomposites, this book primarily focuses on the processing and properties of different eco-friendly polymer nanocomposites procured from diverse sustainable resources and techniques. Several critical issues and suggestions for future work are comprehensively discussed in this book with the hope that the book will provide deep insight into the state of art of "Eco-friendly Polymer Nanocomposites". We would like to thank the Publisher for the invaluable help in the organisation of the editing process.

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