

# Preface

Nanotechnology is the understanding and control of materials having dimensions roughly within the 1–100 nm range. The essence of nanotechnology is the ability to work at the molecular level, atom-by-atom, to create large structures with fundamentally new molecular organization. The ability to control and manipulate nanostructures will make it possible to exploit new physical, biological and chemical properties of systems that are intermediate in size, between single atoms, molecules and bulk materials. The term nanotechnology was introduced starting with the famous 1959 lecture by R.P. Feynman. The progress in nanotechnology has provided new insights into applications of well-known materials due to their exceptional properties owing to the nanoscale. As an example, nanocomposites based on polymer matrix and nanoscale fillers have appeared as good candidates in a broad range of applications. Such scenario can be credited to the use of new and multifunctional fillers that provide distinct and substantial features to the nanocomposites.

Recent trends in the nanocomposites field show the extensive use of biobased/ environmental friendly materials as one of the component in these materials. Particular attention has been focused on the use of biodegradable polymer as matrix component in nanocomposite applications because of their widespread huge potential and advantages over other traditional synthetic materials. The use of natural polymers-based materials by humans is not new as these polymer materials have been used by people of earlier civilizations long back, many centuries ago. Among the biodegradable matrices of natural origin are, in particular, polysaccharides (starch, cellulose, pectin or chitin/chitosan); proteins (casein or gluten); and lipids (fatty acids, resins and waxes), which have the ability to form nanocomposite films that are non-toxic, and biocompatible and have the advantage of being able to be in contact with food products. Indeed, the nano-products play a dominant role in global manufacturing, and also in the not-so-distance future. Whereas new applications are being investigated every day in numerous areas, e.g. agriculture, lignocellulosic products, food, nano-reactive membranes for water purification, nanocatalysts for air purification, for water treatment, nanomaterials-based solar cells, as well as nano-coatings which are finding use in corrosion-

resistance, dirt repellence, water repellence, thermal insulation and anti-microbial to name a few. Eco-friendly polymer nanocomposites are such emerging nanostructure hybrid materials composed of environmental friendly components. Eco-friendly nanocomposites are becoming a subject of intensive research owing to their inherent properties such as non-toxicity, biocompatibility, biodegradability as well as improved structural and functional properties. Different research efforts all around the globe are continuing to improve the existing properties of these eco-friendly polymer nanocomposites. Researchers are collectively focusing their efforts to use the inherent advantages of eco-friendly materials for their targeted applications. Scientists in collaboration with industries are extensively developing new classes of eco-friendly polymer nanocomposites. Different kinds of sustainable materials can be obtained by exploration of such eco-friendly polymer nanocomposites.

This book is solely focused on “Eco-friendly Polymer Nanocomposites” and deals with the “Chemistry and Applications” aspects of these materials. 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 team at Springer for their invaluable help in the organisation of the editing process. Finally, we would like to thank our parents for their continuous encouragement and support.

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