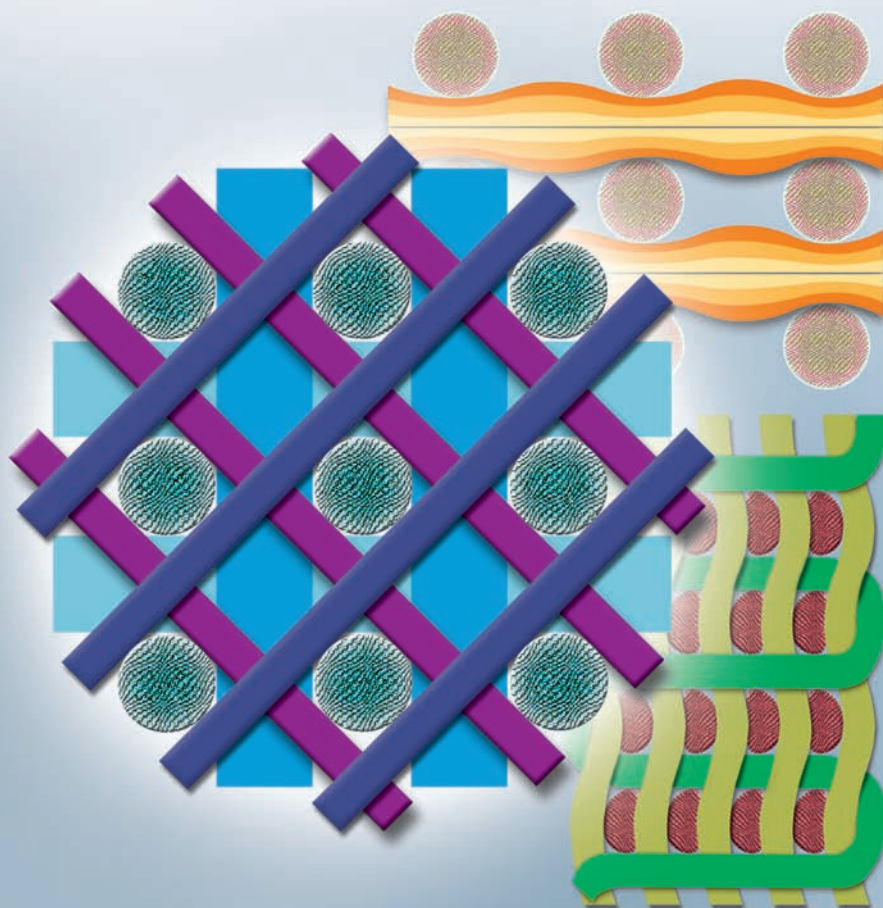


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S. K. Malhotra, Koichi Goda, M. S. Sreekala

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Polymer Composites

Volume 1: Macro- and Microcomposites



Edited by
Sabu Thomas, Kuruvilla Joseph,
Sant Kumar Malhotra,
Koichi Goda, and Meyyarappallil
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Preface

Composite materials, usually man-made, are a three-dimensional combination of at least two chemically distinct materials, with a distinct interface separating the components, created to obtain properties that cannot be achieved by any of the components acting alone. In composites, at least one of the components called the reinforcing phase is in the form of fibers, sheets, or particles and is embedded in the other materials called the matrix phase. The reinforcing material and the matrix material can be metal, ceramic, or polymer. Very often commercially produced composites make use of polymers as the matrix material. Typically, reinforcing materials are strong with low densities, while the matrix is usually a ductile, or tough, material. If the composite is designed and fabricated adequately, it combines the strength of the reinforcement with the toughness of the matrix to achieve a combination of desirable properties not available in any single conventional material.

The present book focuses on the preparation and characterization of polymer composites with macro- and microfillers. It examines the different types of fillers especially as the reinforcing agents. The text reviews the interfaces in macro- and microcomposites and their characterization. Advanced applications of macro- and micropolymer composites are discussed in detail. This book carefully analyses the effect of surface modification of fillers on properties and chemistry and reinforcing mechanism of composites. It also introduces recovery, recycling, and life cycle analysis of synthetic polymeric composites.

The book is organized into five parts. Part One contains four chapters. Chapter 1 is an introduction to composites, classification, and characteristic features of polymer composites, their applications in various fields, state of the art, and new challenges and opportunities.

Chapter 2 focuses on micro- and macromechanics of polymer composites. Knowledge of micro- and macromechanics is essential for understanding the behavior, analysis, and design of polymer composite products for engineering applications.

Chapter 3 deals with interfaces in macro- and microcomposites. Interface plays a big role in physical and mechanical behavior of polymer composites. It deals with the various techniques and analyses of the interfacial properties of various polymer composite materials.

Chapter 4 describes various preparation and manufacturing techniques for polymer composites starting with simplest hand lay-up (contact molding) to sophisticated autoclave molding and CNC filament winding methods.

Part Two deals with fiber-reinforced polymer composites and Part Three discusses textile composites.

Each of the seven chapters included in Part Two deals with a particular fiber as reinforcement for polymer matrices. These fibers are carbon, glass, Kevlar, polyester, nylon, polyolefin, and silica.

Each of the four chapters included in Part Three deals with a particular form of textiles as reinforcement. These textiles are 2D woven fabric, 3D woven fabric, geotextiles, and hybrid textiles.

The first five chapters included in Part Four deal with different microsized fillers reinforcing the polymer matrix. Different microparticulate fillers include carbon black, silica, metallic particles, magnetic particles, mica (flakes), and so on. The last chapter of this part deals with viscoelastically prestressed polymer composites.

Finally, Part Five studies applications of macro- and microfiller-reinforced polymer composites. Polymer composites find applications in all types of engineering industry, namely, aerospace, automobile, chemical, civil, mechanical, electrical, and so on. They also find applications in consumer durables, sports goods, biomedical, and many more areas.

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