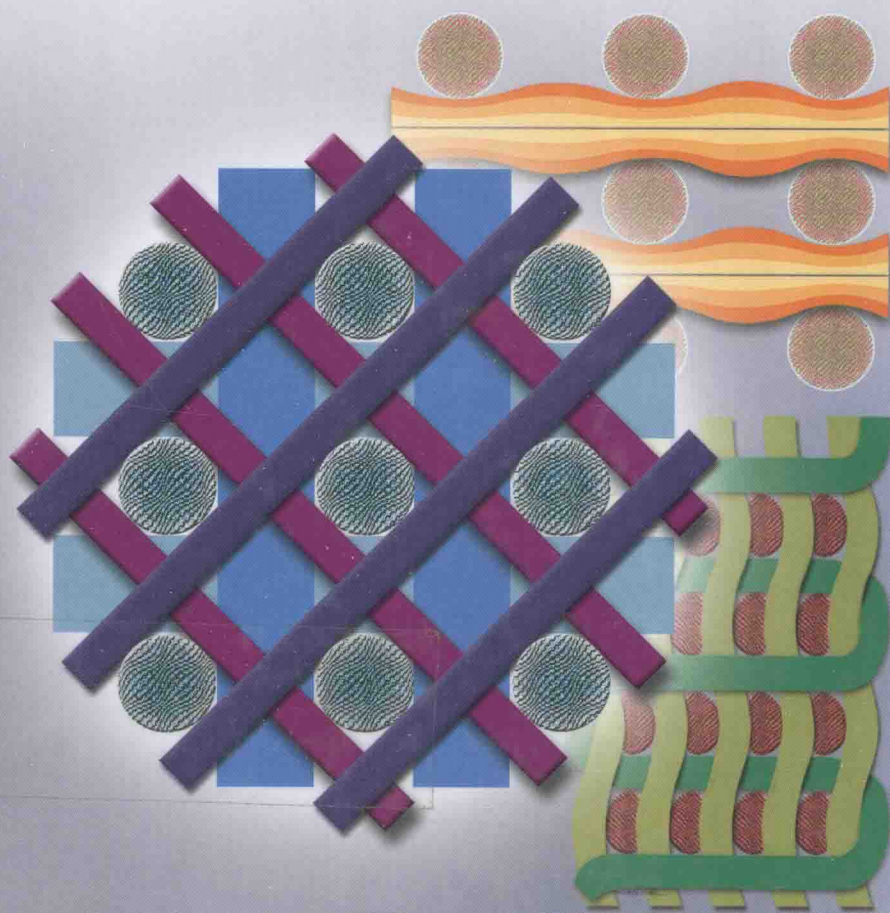


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S. K. Malhotra, Koichi Goda, M. S. Sreekala

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Polymer Composites

Volume 1: Macro- and Microcomposites



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

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The Editors

Prof. Dr. Sabu Thomas

Mahatma Gandhi University
School of Chemical Sciences
Priyadarshini Hills P.O.
Kottayam, Kerala 686560
India

Prof. Dr. Kuruville Joseph

Indian Institute of Space Science
and Technology
ISRO P.O., Veli
Thiruvananthapuram, Kerala 695022
India

Dr. Sant Kumar Malhotra

Flat-YA, Kings Mead
Srinagar Colony
14/3, South Mada Street
Saidafet, Chennai 60015
India

Prof. Koichi Goda

Yamaguchi University
Faculty of Engineering
Department of Mechanical Engineering
Tokiwadai 2-16-1
Ube, Yamaguchi 755-8611
Japan

Dr. Meyyarappallil Sadasivan Sreekala

Assistant Professor
Post Graduate Department of Chemistry
SreeSankara College
Kalady, Kerala 683574
India

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Sadasivan Sreekala

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The Editors

Sabu Thomas is a Professor of Polymer Science and Engineering at Mahatma Gandhi University (India). He is a Fellow of the Royal Society of Chemistry and a Fellow of the New York Academy of Sciences. Thomas has published over 430 papers in peer reviewed journals on polymer composites, membrane separation, polymer blend and alloy, and polymer recycling research and has edited 17 books. He has supervised 60 doctoral students.

Kuruvilla Joseph is a Professor of Chemistry at Indian Institute of Space Science and Technology (India). He has held a number of visiting research fellowships and has published over 50 papers on polymer composites and blends.

S. K. Malhotra is Chief Design Engineer and Head of the Composites Technology Centre at the Indian Institute of Technology, Madras. He has published over 100 journal and proceedings papers on polymer and alumina-zirconia composites.

Koichi Goda is a Professor of Mechanical Engineering at Yamaguchi University. His major scientific fields of interest are reliability and engineering analysis of composite materials and development and evaluation of environmentally friendly and other advanced composite materials.

M. S. Sreekala is an Assistant Professor of Chemistry at Post Graduate Department of Chemistry, SreeSankara College, Kalady (India). She has published over 40 papers on polymer composites (including biodegradable and green composites) in peer reviewed journals and has held a number of Scientific Positions and Research Fellowships including those from the Humboldt Foundation, Germany and Japan Society for Promotion of Science, Japan.

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 micro-sized 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.

*Sabu Thomas, Kuruvilla Joseph,
Sant Kumar Malhotra, Koichi Goda,
and Meyyarappallil Sadasivan Sreekala*

List of Contributors

Boudjemaa Agoudjil

Université El-Hadj-Lakhdar-Batna
LPEA
1, rue Boukhrouf Med El-Hadi
05000 Batna
Algeria

Tamás Bárány

Budapest University of Technology and
Economics
Department of Polymer Engineering
Műegyetem rkp. 3
1111 Budapest
Hungary

Philippe Boisse

INSA Lyon
LaMCoS
Bat Jacquard
27 Avenue Jean Capelle
69621 Villeurbanne Cedex
France

Abderrahim Boudenne

Université Paris-Est Val de Marne
CERTES
61 Av. du Général de Gaulle
94010 Créteil Cédex
France

Valerio Causin

Università di Padova
Dipartimento di Scienze Chimiche
Via Marzolo 1
35131 Padova
Italy

Mark Christopher

University of Waikato
Department of Engineering
Gate 1 Knighton Road
Private Bag 3105
Hamilton 3240
New Zealand

Tibor Czirány

Budapest University of Technology and
Economics
Department of Polymer Engineering
Műegyetem rkp. 3
1111 Budapest
Hungary

Chapal K. Das

Indian Institute of Technology
Materials Science Centre
Kharagpur 721302
India

Tamás Deák

Budapest University of Technology and
Economics
Department of Polymer Engineering
Muegyetem rkp. 3
1111 Budapest
Hungary

Kevin S. Fancey

University of Hull
Department of Engineering
Cottingham Road
Hull HU6 7RX
UK

Bertrand Garnier

Ecole Polytechnique de l'université de
Nantes
ITN-UMR CNRS6607
Rue Christian Pauc, BP 50609
44306 Nantes Cdx 03
France

Koichi Goda

Yamaguchi University
Department of Mechanical Engineering
Tokiwadai
Ube 755-8611
Yamaguchi
Japan

Hajnalka Hargitai

Széchenyi István University
Department of Materials and Vehicle
Manufacturing Engineering
9026 Győr Egyetem tér 1
Hungary

Sebastian Heimbs

European Aeronautic Defence and
Space Company
Innovation Works
81663 Munich
Germany

Yuko Ikeda

Kyoto Institute of Technology
Graduate School of Science and
Technology
Matsugasaki
Kyoto 606-8585
Japan

Han-Yong Jeon

Inha University
Division of Nano-Systems Engineering
253, Yonghyun-dong, Nam-gu
Incheon 402-751
South Korea

Josmin P. Jose

Mahatma Gandhi University
School of Chemical Sciences
Polymer Science & Technology
Priyadarshini Hills
Kottayam 686560
Kerala
India

Kuruvilla Joseph

Indian Institute of Space Science and
Technology (IIST)
Department of Chemistry
Valiamala P.O.
Thiruvananthapuram 695547
Kerala
India

József Karger-Kocsis

Budapest University of Technology and
Economics
Department of Polymer Engineering
Muegyetem rkp. 3
1111 Budapest
Hungary

and

Tshwane University of Technology
Faculty of Engineering and Built
Environment
Polymer Technology
P.O. X680
0001 Pretoria
Republic of South Africa

Atsushi Kato

NISSAN ARC, Ltd.
Research Department
Natsushima-cho 1
Yokosuka
Kanagawa 237-0061
Japan

Natalie E. Kazantseva

Tomas Bata University in Zlin
Faculty of Technology
Polymer Center
T.G. Masaryk Sq. 5555
760 01 Zlin
Czech Republic

Bong-Rae Kim

Korea Advanced Institute of Science
and Technology
Department of Civil and Environmental
Engineering
373-1 Guseong-dong
Yuseong-gu
Daejeon 305-701
South Korea

Shinzo Kohjiya

Kyoto Institute of Technology
Graduate School of Science and
Technology
Matsugasaki
Kyoto 606-8585
Japan

Wen-Shyong Kuo

Feng Chia University
Department of Aerospace and Systems
Engineering
No. 100 Wenhwa Road
Seatwen
Taichung 40724
Taiwan R.O.C.

Haeng-Ki Lee

Korea Advanced Institute of Science and
Technology
Department of Civil and Environmental
Engineering
373-1 Guseong-dong
Yuseong-gu
Daejeon 305-701
South Korea

Xianping Liu

University of Warwick
School of Engineering
Coventry CV4 7AL
UK

Sant Kumar Malhotra

Composites Technology Centre
IIT Madras
Chennai 600036
Tamil Nadu
India

Sreekala M. S.

Assistant Professor
Post Graduate Department of
Chemistry
SreeSankara College, Kalady
Kerala 683574
India

Dionysis E. Mouzakis

Technological Educational Institute of
Larisa
School of Technological Applications
Department of Mechanical Engineering
T.E.I. of Larisa
411 10 Larisa
Greece

Ganesh C. Nayak

Indian Institute of Technology
Materials Science Centre
Kharagpur 721302
India

Soo-jin Park

Inha University
Department of Chemistry
253, Yonghyun-dong, Nam-gu
Incheon 402-751
South Korea

Volker Pöthner

Karlsruhe Institute of Technology (KIT)
Institute for Applied Materials
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen
Germany

Laly A. Pothan

Bishop Moore College
Department of Chemistry
Mavelikara 690101
Kerala
India

Vikas Prakash

Case Western Reserve University
Department of Mechanical and
Aerospace Engineering
10900 Euclid Avenue
418 Glennan Building LC-7222
Cleveland, OH 44106-7222
USA

Jürgen Prokop

Karlsruhe Institute of Technology (KIT)
Institute for Applied Materials
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen
Germany

Ilona Rácz

Bay Zoltán Institute for Materials
Science and Technology
Fehérvári u. 130
1116 Budapest
Hungary

Rathanasamy Rajasekar

Indian Institute of Technology
Materials Science Centre
Kharagpur 721302
India

Sudip Ray

University of Auckland
School of Chemical Sciences
Private Bag 92019
Auckland 1142
New Zealand

Min-Kang Seo

Jeonju Institute of Machinery and
Carbon Composites
Aircraft Parts Division
750-1, Palbok-dong
Deokjin-gu
Jeonju 561-844
South Korea

Palanisamy Sivasubramanian

Department of Mechanical Engineering
SaintGITS College of Engineering
Pathamuttom
Kottayam-686532
Kerala
India

Meyyarappallil Sadasivan Sreekala

Department of Polymer Science and
Rubber Technology
Cochin University of science and
Technology
Cochin- 682022
Kerala
India

M. Thiruchitrambalam

Department of Mechanical Engineering
Tamilnadu College of Engineering
Coimbatore
Tamilnadu
India

Sabu Thomas

Mahatma Gandhi University
School of Chemical Sciences
Kottayam 686560
Kerala
India

Björn Van Den Broucke

European Aeronautic Defence and
Space Company
Innovation Works
81663 Munich
Germany

John Verbeek

University of Waikato
Department of Engineering
Gate 1 Knighton Road
Private Bag 3105
Hamilton 3240
New Zealand

Emmanuelle Vidal-Sallé

INSA Lyon
LaMCoS
Bat Jacquard
27 Avenue Jean Capelle
69621 Villeurbanne Cedex
France

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