

Textile Science and Clothing Technology

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Sohel Rana · Raul Figueiro
Editors

Fibrous and Textile Materials for Composite Applications

 Springer

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*Dedicated to my mentor and dearest
grandfather, Md. Abdur Razzaque, who has
always loved, guided and inspired me and
without whose endless efforts and inspiration
this book was not possible*

—Sohel Rana

To my father

—Raul Fanguero

Preface

The possibility to achieve any targeted sets of properties has promoted the wide application of composite materials in various industrial sectors. Composites and nanocomposites are being considered as superior materials for aerospace, transportation, sports, civil construction, medical and in many other technical sectors. Fibrous and textile materials have been extensively used in composite materials in different forms (short fibres, tows, fabrics, mats, nanofibre webs, etc.) for reinforcing purpose or for adding various functionalities. Huge flexibility in terms of material selection, structure designing and achievable properties led to their extensive utilization in composite materials.

This book focuses on the different types of fibrous and textile materials applied in composite industries. An introductory discussion on the definition and fundamental aspects of composite materials, types of composites, reinforcements, matrices and applications is presented in the chapter “[Introduction to Composite Materials](#)”. Chapter “[Essential Properties of Fibres for Composite Applications](#)” presents various essential properties of fibres for their successful application to composite materials. As fibres are used in various forms in composite materials such as short fibres, unidirectional tows, directionally oriented structures or advanced 2D and 3D textile structures, these different forms and architectures of fibres have been presented in the chapter “[Fiber Architectures for Composite Applications](#)”. The subsequent chapters, i.e. “[Synthetic Fibres for Composite Applications](#)”, “[Natural Fibers for Composite Applications](#)”, “[Metallic Fibers for Composite Applications](#)” cover various synthetic, natural, as well as metallic fibres used for reinforcement of polymeric, cementitious, metallic and other matrices. Properties of these fibres, their manufacturing process, processing and properties of composites are discussed in detail. Looking at the tremendous growth in the nanofibre market in recent times, the properties, processing and composite application of carbon nanofibres (also nanotubes) and natural nanofibres are presented in the chapters “[Carbon Nanofibres and Nanotubes for Composite Applications](#)” and “[Natural Nanofibres for Composite Applications](#)”, respectively. In the chapter “[Surface Preparation of Fibres for Composite Applications](#)”, different surface

treatments and finishes which are applied to improve the fibre/matrix interface and other essential properties of composites are covered. Detailed discussions of some special properties of fibres and composites such as piezoresistivity, self-sensing, self-healing, electromagnetic shielding, etc., which are essential requirements for advanced multifunctional composites, have been included in the chapter “[Reinforcements and Composites with Special Properties](#)”. The concluding chapter “[Comparison of Performance, Cost-Effectiveness and Sustainability](#)” presents the comparison of performance, cost-effectiveness and sustainability aspects of different fibres used in composite industries. In all of these chapters, both the existing technologies used in commercial applications and the recently explored advanced research and developments are presented.

This book is a complete collection of information on all types of fibres and textile structures used to reinforce a wide variety of materials including polymers, cement, metal, soils and so on to improve their general performances as well as multifunctional behaviours. Therefore, we believe that this book will serve as a highly useful reference for a wide range of readers, including engineers, bachelor, master and Ph.D. students, teachers as well as advanced researchers both from academics and industry, covering different disciplines such as textile engineering, fibre science and technology, materials science, mechanical engineering, chemical engineering, nanotechnology, medical sciences, environmental science and so on.

We would like to express our sincere thanks and gratitude to all authors, who have contributed to different chapters, for their excellent efforts. Sincere thanks are also due to the members of the Fibrous materials research group (Fibrenamics) of University of Minho for their kind help and support throughout the preparation of the book.

Sohel Rana
Raul Fanguero

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