Springer Series on Polymer and Composite Materials

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Electrospun Nanofibers

Fabrication, Functionalisation and Applications

Springer

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Preface

Nanofibers have stimulated a new class of material which employed for a considerable range of applications from medical to consumer products such as, filtration, wound dressing, adsorbent, energy storage, protein separation, immobilization, drug delivery, and composites. Currently, the electrospinning of nanofibers is emerging as a specialized processing technique for the formation of sub-micron fibers, with high specific surface areas. This procedure does not need the use of high temperature or the coagulation process to yield solid threads of the materials from the solution. This makes the electrospinning technique, particularly suitable to produce the desired kind of fibers using a complex molecular system. Owing to the scalable production rate and simplicity of the experimental setup turn out electrospinning device exceedingly attractive to both industry and academia. The main advantage of this technique is that the researchers could tailor and produce desired types of nanofibers using a variety of materials with required functional groups onto the surface of the fiber by tuning the assemblies of the electrospinning device. This technique offers an adorable route to incorporate nanoparticles into the polymer fibers. Therefore, in this book, we would like to deliberate and explore in deep about the current advances in research activities related to the electrospun nanofiber, selective functionalization of nanofiber, incorporation of 1D, 2D, or 3D nanomaterials into nanofiber with the help of the electrospinning technique, and applications of these nanomaterials in various research areas. Moreover, in this book, special attention has been paid to the growing application of electrospun nanofibers in energy as well as environmental research. The book contains 13 chapters and each chapter provides the basic knowledge and deep ongoing research in recent days. The present book assesses the delineation of various techniques of fabrication and functionalization of electrospun nanofibers and their advanced applications in different areas, which will be an asset to beginners. The book will provide the execution of fabrication and functionalization of electrospun nanofibers into practical devices via the knowledge of various materials. However, our main aim with this book is to inspire and develop young minds towards electrospun nanofibers research for future prospects. We are grateful to the authors of the chapters for their exceptional assistance in the completion of the book. We would

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Surface Engineering of Nanofiber Membranes via Electrospinning-Embedded Nanoparticles for Wastewater Treatment

Jagdeep Singh, Sourbh Thakur, Rakesh Sehgal, A. S. Dhaliwal, and Vijay Kumar

Abstract Nanofibers (NFs) are fibers with diameters in the nanometer range and have found numerous applications due to their unique properties. Researchers are still trying to improve the properties of electrospun-based fibers by using unique nanomaterials for solving environmental problems especially the treatment of wastewater. The modification of NFs has been carried out by decorating and embedding the various types of nanoparticles, such as noble metals, carbon nanomaterials, and metal oxide nanoparticles onto the surface of the membrane. The decorated surface of the NFs membrane possesses high surface area, surface energy, additional functionality, and anti-fouling properties that make them a suitable candidate for wastewater treatment application. This chapter highlights the modern trends in the surface engineering of NFs via electrospinning embedded nanoparticles (NPs) for wastewater treatment. The shape and size of Ag and Au NPs prepared under different reducing and stabilizing agents are also reviewed. The electrospun polymer NFs embedded with different NPs and surface modifications of NF membranes are discussed. The critical issues related to the use of electrospun polymer NFs embedded with different NPs for wastewater treatment along with a concluding note on possible future directions on this have also been included.

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