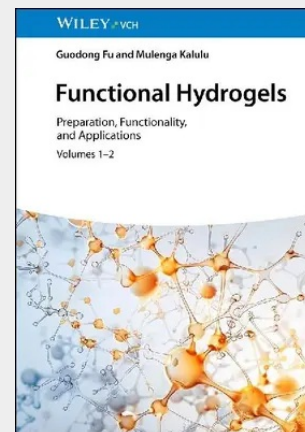


Functional Hydrogels

Preparation, Functionality, and Applications 2 Volume Set

Comprehensive exploration of hydrogels, from molecular design to advanced technologies Functional Hydrogels: Preparation, Functionality, and Applications presents a comprehensive two-volume exploration of one of the most versatile classes of soft materials in modern science and engineering. Bringing together advances in chemistry, materials science, biology, and applied engineering, the book traces the evolution of hydrogels from simple water-swollen networks to adaptive, multifunctional platforms driving innovation across healthcare, sustainability, and technology. The first volume provides a scientific foundation, covering the evolution of hydrogel research, polymerization and fabrication strategies, network construction, bioprinting, and functionalization. The second volume focuses on applications at the frontiers of science and industry, highlighting hydrogel-based actuators, advanced drug delivery systems, regenerative medicine scaffolds, wearable devices, and neural interfaces alongside applications in environmental remediation, food and packaging, energy storage, and agriculture. Functional Hydrogels discusses: - Conventional polymerization methods such as free radical polymerization (FRP), covering initiation mechanisms, propagation and termination, and monomer systems and crosslinkers - Techniques for hydrogels for bioprinting, covering extrusion-based, inkjet-based, laser-assisted, and stereolithography (SLA)-based bioprinting - Challenges and future prospects in nanomaterial integration, including bioactivity preservation, functionalization efficiency, and stability and durability - Molecular basis of self-healing hydrogels, covering dynamic covalent bonds with information on disulfide and boronate ester bonds, and non-covalent interactions with information on hydrophobic and host-guest interactions - Environmental impact across the hydrogel lifecycle, covering raw material extraction and synthesis, end-of-life scenarios, and environmental fate Balancing academic rigor with applied relevance, Functional Hydrogels is designed for graduate students, researchers, engineers, and professionals seeking to learn how these adaptive materials are poised to address pressing global challenges, from personalized healthcare to renewable energy and sustainable resource management.

This book serves as a definitive resource, encompassing the entire lifecycle of hydrogels?from their chemistry and synthesis to diverse applications and future potential. Each chapter delves deeply into key aspects of hydrogel research and technology, exploring the evolution and modern significance of functional hydrogels, foundational materials, methods of preparation, and innovations such as stimuli-responsive and hybrid hydrogels. The book examines advanced functionalities like self-healing and shape memory, showcasing the versatility of hydrogels in fields such as biomedicine, robotics, environmental solutions, agriculture, and food packaging. It also provides insights into technical evaluation, biocompatibility, regulatory standards, and eco-friendly advancements, while envisioning novel applications and sustainable practices in hydrogel design. Combining comprehensive scientific details with practical applications and forward-looking perspectives, this book is an invaluable reference for academics, researchers, industry professionals, and anyone interested in the transformative power of hydrogels.



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