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Sommario/riassunto

This unique book provides a comprehensive introduction to the multifaceted realm of functionalized magnetic nanoparticles in the field of theranostics, exploring the fundamental concepts, synthesis methods, characterization techniques, and potential applications. In recent years, the intersection of nanotechnology and medicine has ushered in a new era of therapeutics and diagnostics. Among the myriad nanostructures, magnetic nanoparticles (MNPs) have emerged as versatile candidates with immense potential for theranostic applications. Their unique combination of magnetic properties and functionalization capabilities has paved the way for innovative approaches in both the diagnosis and treatment of various diseases. Understanding the synthesis, characterization, and manipulation of these MNPs is essential for harnessing their full potential in theranostics. Advances in nanotechnology have enabled precise control over their size, shape, and surface chemistry, allowing for tailored functionalities to suit specific biomedical applications. From superparamagnetic iron oxide nanoparticles (SPIONs) to magnetic nanorods and beyond, the diverse landscape of MNPs offers a rich playground for innovation. The convergence of diagnosis and therapy is facilitated by functionalized MNPs; their magnetic properties render them invaluable tools for imaging modalities such as magnetic resonance imaging (MRI), offering high-resolution anatomical and functional information for disease detection and monitoring. Simultaneously, functionalizing MNPs with targeting ligands, therapeutic agents, or stimuli-responsive moieties empowers them to actively engage in targeted drug delivery, hyperthermia, or magnetic manipulation of biological processes. This synergistic approach exemplifies the essence of theranostics—combining therapy and diagnostics to achieve personalized and precise medical interventions. The book discusses the challenges ahead, including the translation of functionalized MNPs from bench to bedside, which necessitates rigorous preclinical and clinical evaluations to ensure safety, efficacy, and biocompatibility. Moreover, the complex interplay between nanoparticles and biological systems demands a multidisciplinary approach, bridging the gap between materials science, biology, and clinical medicine. Regulatory hurdles, scalability issues, and ethical considerations further underscore the need for concerted efforts and strategic collaborations in the development and commercialization of MNP-based theranostic platforms. The readers will find that "Functionalized Magnetic Nanoparticles for Theranostic Applications" comprehensively covers the chemical, structural, and biological properties of functionalized magnetic nanoparticles for theranostic applications as well as most of the challenges. Audience This unique reference book will be of great value to materials engineers, polymer scientists, and technologists working in the electronic, electrical, and biomedical industries. It will also be of great use to graduate, postgraduate, and engineering students working in materials and polymer science.