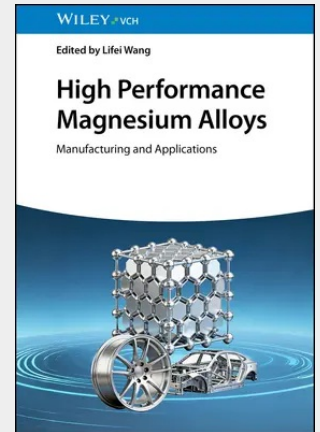


High Performance Magnesium Alloys

Manufacturing and Applications

Advance magnesium alloy development through AI and sustainable processing technologies Magnesium alloys?the lightest structural metals at 1.78 g/cm³?remain constrained by their Hexagonal Close-Packed (HCP) crystal structure?s mechanical limitations. High Performance Magnesium Alloys: Manufacturing and Applications presents technologies developed over the past five years to overcome these barriers, integrating novel alloy design, additive manufacturing, advanced processing, heat treatment, surface engineering, and simulation modeling into a single reference. Coverage spans simulation approaches including CPFEM, VPSC, and CA models alongside characterization via SEM, EBSD, TEM, FIB, and in-situ analysis. The book details machine learning applications for alloy optimization, corrosion testing protocols, additive manufacturing parameter frameworks, and surface modification strategies. Emerging applications in biodegradable implants, hydrogen storage, and energy-efficient manufacturing receive dedicated treatment. Key topics also include: * Casting, severe plastic deformation, and joining techniques tailored to magnesium alloy processing for structural and functional applications * AI-driven alloy design workflows that shorten traditional trial-and-error development timelines for new compositions and target microstructures * Real-world case studies connecting academic research with industrial practice across automotive, aerospace, and electronics sectors * Pre-strain deformation methods and heat treatment protocols optimized for enhancing magnesium alloy ductility and formability at room temperature * Sustainable manufacturing strategies aligned with global decarbonization goals that leverage magnesium?s natural abundance and full recyclability Written for materials scientists, mechanical engineers, solid state chemists and physicists, and industry professionals in automotive, aerospace, and electronics sectors, this book delivers the experimental guidance and theoretical frameworks needed to accelerate magnesium alloy development toward scalable, environmentally responsible applications.

This book comprehensively addresses the advancement of magnesium (Mg) alloys and their applications by presenting cutting-edge technologies and methodologies developed over the past five years, including novel alloy design, additive manufacturing (e.g., 3D printing), advanced processing techniques (casting, severe/pre-strain plastic deformation, joining), heat treatment, surface engineering, and simulation modeling approaches like CPFEM, VPSC, and CA, complemented by characterization tools such as SEM, EBSD, TEM, FIB, and in-situ analysis. It bridges academic and industrial knowledge gaps by integrating theoretical insights with engineering practices, emphasizing emerging trends like machine learning, energy storage applications, and sustainable solutions for lightweight and green manufacturing. Targeted at researchers and technicians, the book offers experimental guidance (e.g., corrosion testing, additive manufacturing parameter optimization), highlights breakthroughs in surface modification and alloy innovation, and explores future directions, positioning itself as a critical resource for advancing Mg alloy development and application in global industries.



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