

HfO₂-Based Ferroelectric Materials

Fabrication, Characterization and Device Applications

Explores HfO₂-based ferroelectrics for memory, sensing, and advanced electronic applications

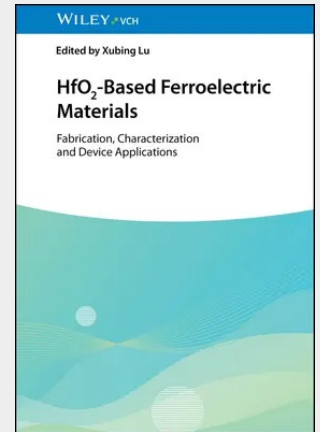
Ferroelectric hafnium oxide (HfO₂)-based materials have transformed the field of electronic materials and device design, offering pathways to overcome long-standing barriers in scalability, compatibility, and reliability. The emergence of robust ferroelectricity in doped HfO₂ has revolutionized both research and industry perspectives, providing a viable solution where conventional ferroelectrics often fell short.

With contributions from leading experts, HfO₂-Based Ferroelectric Materials addresses the critical need for a consolidated reference on HfO₂-based ferroelectrics, offering foundational knowledge as well as the latest insights into fabrication, material characterization, and device integration. The book opens with fundamentals of ferroelectricity and the mechanisms driving HfO₂-based ferroelectric behavior, before progressing to detailed examinations of deposition techniques, superlattice structures, and reliability considerations. It further explores a broad spectrum of applications, including non-volatile memories, neuromorphic computing, compute-in-memory architectures, and negative capacitance transistors, alongside emerging roles in energy storage, microwave technologies, and piezoelectric systems. Special attention is given to persistent challenges such as the wake-up effect, fatigue, and imprint issues and the strategies developed to mitigate them.

An authoritative and well-structured resource for advancing the frontiers of electronic materials and device technologies, HfO₂-Based Ferroelectric Materials:

- * Explains the origins of ferroelectricity in doped HfO₂ and its unique material advantages
- * Details deposition techniques and approaches to regulating ferroelectric behavior
- * Examines device-level challenges, including wake-up effect, fatigue, and imprint reliability
- * Highlights applications spanning non-volatile memories, neuromorphic computing, and energy-efficient devices
- * Discusses advanced designs such as superlattice-like laminate structures and 3D ferroelectric memories
- * Provides insight into the reliability of HfO₂-based thin films, capacitors, and field-effect transistors

HfO₂-Based Ferroelectric Materials: Fabrication, Characterization, and Device Applications is an essential resource for materials scientists, electronics engineers, semiconductor and solid-state physicists, and professionals in the semiconductor and sensor industries. It is also a valuable reference for graduate-level courses in electronic materials, semiconductor devices, and advanced nanotechnology within physics, materials science, and electrical engineering degree programs.



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