**From Sensing to Energy: Metal Oxide Nanostructures for Green Technologies**

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Metal oxides are versatile functional materials widely used in sustainable technologies due to their chemical stability, tunable electronic properties, and ease of integration into miniaturized systems. In the field of chemical sensing, they serve as highly sensitive and selective materials capable of detecting a wide range of gases and biomolecules, which is essential for real-time monitoring in lab-on-a-chip devices and point-of-care medical diagnostics. These applications benefit from the miniaturization, low power consumption, and fast response times enabled by metal oxide-based sensors.

Beyond sensing, metal oxides—such as NiO, ZnO, and CeO₂-based composites—play a critical role in the development of next-generation energy conversion systems like Solid Oxide Fuel Cells (SOFCs). Their function as catalysts and electrode materials supports efficient electrochemical reactions, enabling clean energy production from hydrogen or bio-derived fuels.

Integrating these materials into multifunctional platforms bridges the gap between sensing and energy, paving the way for self-powered diagnostic tools and compact, eco-friendly devices. From a sustainability standpoint, metal oxides offer high availability, recyclability, and compatibility with low-temperature fabrication methods, making them ideal candidates for scalable, green technologies that align with circular economy goals and carbon neutrality strategies.

We will explore the synthesis, characterization, and performance evaluation of chemical sensors and Solid Oxide Fuel Cells (SOFCs) using nanostructured materials. These samples were characterized using Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), and Raman spectroscopy. Electrochemical performance, including I–V characteristics and Electrochemical Impedance Spectroscopy (EIS), was evaluated at different temperatures and gas flow conditions.

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