

## ORR Electrocatalyst for Batteries and Fuel Cells Development with SiO<sub>2</sub>/Carbon Black Based Composite Nanomaterials

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**Abstract :** This study focuses on the development of composite nanomaterials based on SiO<sub>2</sub> and carbon black for oxygen reduction reaction (ORR) electrocatalysts in batteries and fuel cells. The aim was to explore the potential of these composite materials as efficient catalysts for ORR, which is a critical process in energy conversion devices. The SiO<sub>2</sub>/carbon black composite nanomaterials were synthesized using a facile and scalable method. The morphology, structure, and electrochemical properties of the materials were characterized using various techniques, including scanning electron microscopy (SEM), X-ray diffraction (XRD), and electrochemical measurements. The results demonstrated that the incorporation of SiO<sub>2</sub> into the carbon black matrix enhanced the ORR performance of the composite material. The composite nanomaterials exhibited improved electrocatalytic activity, enhanced stability, and increased durability compared to pure carbon black. The presence of SiO<sub>2</sub> facilitated the formation of active sites, improved electron transfer, and increased the surface area available for ORR. This study contributes to the advancement of battery and fuel cell technology by offering a promising approach for the development of high-performance ORR electrocatalysts. The SiO<sub>2</sub>/carbon black composite nanomaterials show great potential for improving the efficiency and durability of energy conversion devices, leading to more sustainable and efficient energy solutions.

**Keywords :** oxygen reduction reaction, batteries, fuel cells, electrocatalyst

**Conference Title :** ICCMAS 2024 : International Conference on Composites, Materials, and Structures

**Conference Location :** New York, United States

**Conference Dates :** July 11-12, 2024