

FACILE SYNTHESIS OF CeO₂ NANOFIBER/F-MXENE NANOCOMPOSITES WITH ENHANCED STRUCTURAL INTEGRATION FOR ADVANCED FUNCTIONAL APPLICATIONS

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Abstract

Cerium oxide (CeO₂) nanostructures have attracted considerable attention due to their outstanding physicochemical properties, including high chemical stability and large specific surface area. In this study, a CeO₂ nanofiber/F-MXene nanocomposite was successfully synthesized through a combination of electrospinning, acid etching, and hydrothermal methods. CeO₂ nanofibers were first fabricated via electrospinning and subsequently calcined at 500°C for 2 h to obtain crystalline CeO₂ nanofibers. Meanwhile, F-MXene was prepared by selectively etching the aluminum (Al) layer from the Ti₃AlC₂MAX phase using hydrofluoric acid (HF), resulting in Ti₃C₂T_x MXene with surface functional groups. The CeO₂ nanofibers were then integrated with F-MXene sheets through a hydrothermal process to enhance interfacial interaction and structural adhesion between the components. The crystalline structure, surface morphology, and chemical bonding characteristics of the synthesized materials were systematically characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), Raman spectroscopy, and Fourier transform infrared spectroscopy (FTIR). The results confirm the successful formation of CeO₂ nanofibers and their effective incorporation with F-MXene within the composite structure. This work provides a feasible strategy for the fabrication of CeO₂/MXene nanocomposites and offers fundamental insights into their structural properties for potential applications in advanced functional materials.

Keyword: CeO₂ nanofiber, F-MXene, Nanocomposite, Electrospinning, Hydrothermal synthesis