

Alloyed $\text{CeCa}_x\text{Fe}_{1-x}\text{O}_{3-\delta}$: A calcium doped cerium iron oxide nanomaterial for photo-fenton degradation

Abstract

The widespread application of mixed metal iron oxide materials in diverse environmental contexts makes them highly significant in heterogeneous catalysis. This study focuses on the synthesis of $\text{CeCa}_x\text{Fe}_{1-x}\text{O}_{3-\delta}$ ($x = 0, 0.2, 0.5, 0.8,$ and 1) nanomaterials using the sol-gel method and explores their structural, electrical, magnetic, optical, and photocatalytic properties. Comprehensive characterization was performed using Powder X-ray Diffraction (PXRD), Fourier Transform Infrared Spectroscopy (FTIR), High-Resolution Transmission Electron Microscopy (HRTEM), Brunauer–Emmett–Teller (BET) surface area analysis, Vibrating Sample Magnetometry (VSM), and UV–Visible Diffuse Reflectance Spectroscopy (UV-DRS). The diffraction peaks confirmed the formation of CeFeO_3 -based structures. The magnetic behavior of the materials was analyzed through saturation magnetization, remanent magnetization, and coercivity. The optical properties, particularly in the visible region, motivated further exploration of the photo-Fenton activity of these nanomaterials, highlighting their potential in environmental remediation applications.

Keywords

Heterogeneous catalysis; Mixed metal oxide; Photo-Fenton; Photocatalysis; Sol-gel