

The Facile One–Pot Hydrothermal Synthesis and Characterizations of Heulandite/NiO Nanocomposite

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Abstract: *In this study, we report the synthesis and characterization of a Heulandite-Nickel oxide (Heu/NiO) nanocomposite using a facile hydrothermal route. Heulandite, a natural zeolite crystal, was firstly pre-treated and then combined with nickel oxide nanoparticles under hydrothermal conditions at 180°C for 12h to form a nanocomposite. The hydrothermal process facilitated the combination of NiO nanoparticles onto the surface of Heulandite crystals, changing the structural and functional properties. The resulting Heu-NiO nanocomposite was characterized using a variety of techniques, including powder X-ray diffraction (PXRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM). XRD analysis confirmed the crystalline structure of both Heulandite and Heu-NiO nanocomposites, while SEM shown the uniform distribution of NiO nanoparticles on the surface of Heulandite. The FTIR spectra revealed characteristic bands associated with Heulandite aluminosilicate framework and NiO, demonstrating the presence of key functional groups and metal-oxygen bonds. The average crystalline sizes of the prepared NCs were calculated by the Debye-Scherrer equation. This work demonstrates the effective synthesis of a Heulandite-Nickel oxide nanocomposite and its characterizations.*

Keywords: Natural Zeolite, Heulandite, MOs (Metal Oxides), PXRD, FTIR, SEM