Polymer Bulletin
https://doi.org/10.1007/s00289-024-05330-w

ORIGINAL PAPER

Effect of various polymer types on Fe_2O_3 nanocomposite characteristics: insights from microstructural morphological, optical and band gap analyses

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Received: 17 September 2023 / Revised: 7 May 2024 / Accepted: 22 May 2024

Abstract

This study illustrates the impact of different polymer types on the characteristics of Fe_2O_3. The manufacture of nanocomposites involved the use of polyethylene oxide (PEO), polyvinyl alcohol (PVA), and Poly (methyl methacrylate) (PMMA) polymers. Nanocomposites were synthesised by combining an aqueous solution of Ferric chloride with various polymers. The Fe_2O_3 nanocomposite, which was polymer-based, was synthesised using an in situ chemical approach to investigate the impact of different polymer types on its primary physical characteristics. The configuration of polymer-based Fe_2O_3 nanocomposites was investigated using diagnostic instruments such as SEM, EDX, and XRD. The modification of the polymer had a clearly noticeable and apparent effect on the optical and structural properties of the nanocomposites. The utilisation of SEM, XRD, and EDX techniques provided confirmation of the successful synthesis of nanocomposites based on Fe_2O_3. The UV–visible spectra were examined to investigate the optical characteristics of the fabricated samples. The bandgaps of the nanocomposites ranged from 1.9 to 2.25 eV. The Urbach energy was also determined for all of the processed samples.

Keywords Fe_2O_3 nanoparticles · Polymer matrix · Capped nanoparticles · Physical properties · Energy gap · Nanocomposites

Introduction

Nanocomposites (NCs) with a size of at least 1 nm have promising uses thanks to their remarkable performance, versatility in design, and synergy of exceptional features. Depending on the specific reinforced nano-filler, NCs with a matrix and

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online: 21 June 2024