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Investigation of samarium-doped hematite nanostructure prepared by hydrothermal method: characterization and application

The hydrothermal method was used to synthesize the hematite phase in this study. To investigate the effect of doping with rare earth metal on the metal oxide semiconductor (MOS) and also to explore the structural, morphology, and optical properties of the hematite phase, four samples with different doping percentages of the samarium (sm) were prepared (0%, 2%,4% and 6%). As-prepared samples underwent different characterizations. X-ray diffraction (XRD) was used to study the crystalline structure and also to confine the rhombohedral of hematite, Scanning electron microscopy (SEM) was used to study the surface morphology of the material while (TEM) Transmission electron microscopy was used to study structural properties of the material. UV-Vis spectroscopy to study the band gap of the material, the thermal stability, and the composition of the material were studied by using the thermogravimetric analysis (TGA). Finally, the overall result suggests that this material has the potential to be used in different applications such as in water treatment, and environmental applications such as in gas sensors.To further study the properties of the material the crystalline size (D), was calculated by using the Scherrer equation, the dislocation density was by using this equation,(2) and the band gap of the material was calculated by using the tau plot equation.

$D = k\lambda/(\beta\cos(\theta))$

⊠ = 1/〖(D)〗^2

Where D representing the crystal size in nm, k is the constant, β is the full width half maximum of the intensity (radian), λ is the X-ray wavelength, θ is the Bragg's diffraction angles and ⊠ is the dislocation density [1].

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