

# Preparation and Characterizations of $\text{MgFe}_2\text{O}_4$ Spinel Semiconductor

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## ABSTRACT

### Introduction

The attention in the synthesis of magnetic nanocomposites has been developed enormously in recent years owing to the unique properties of these materials, such as crystallinity, crystallite size, specific surface area, particle size, morphology and catalytic activity [1]. They have great potential for applications in various fields such as engineering, physics, chemistry, biology and medicine. Nanosized spinel ferrite composites exhibit significant photocatalytic properties to be applied in the solar energy conversion and water purification [2]. As application, these oxides were successfully tested for the degradation of dyes [3], H<sub>2</sub> production and metal reduction [4] under solar light.

### Experimental/Theoretical Study

In the present research,  $\text{MgFe}_2\text{O}_4$  oxide synthesized by nitrate route via nitrates precursors salts, is a narrow band gap semiconductor crystallizing in spinel structure. Various techniques including: X-Ray fluorescence (XRF), TG-analysis, X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), UV-Visible Spectroscopy and Scanning Electron Microscopy (SEM-EDX) are used to characterize the material.

### Results and Discussion

The XRD analysis of the so prepared powder indicates a cubic symmetry spinel structure with an average crystallite size of 13nm. The direct optical band gap  $E_g$  (1.91 eV), determined from the diffuse reflectance, is due to the lifting of degeneracy of Fe  $3d$  orbital octahedrally coordinated. The SEM analysis of  $\text{MgFe}_2\text{O}_4$  surface shows a uniform morphology with regular grain size in the range of 0.1- 0.5  $\mu\text{m}$ . The EDX elemental analysis supports the presence of only Mg, Fe and O without any other polluting element. The electrochemical analysis is also undertaken.



## Conclusion

This work was devoted to the preparation of the spinel  $\text{MgFe}_2\text{O}_4$  by nitrate route and the physical and electrochemical properties, which have been combined to establish the potential / energy diagram. Various techniques were used for the characterization of synthesized sample. The crystalline size of the  $\text{MgFe}_2\text{O}_4$  as calculated by XRD pattern was 13 nm. The mixed oxide has an optical gap of 1.91 eV.

**Keywords:** Spinel  $\text{MgFe}_2\text{O}_4$ , Nitrate route, Semiconductor.

## References

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