Synthesis of Tin Ferrite Nanoparticles and their Electrochemical Performance

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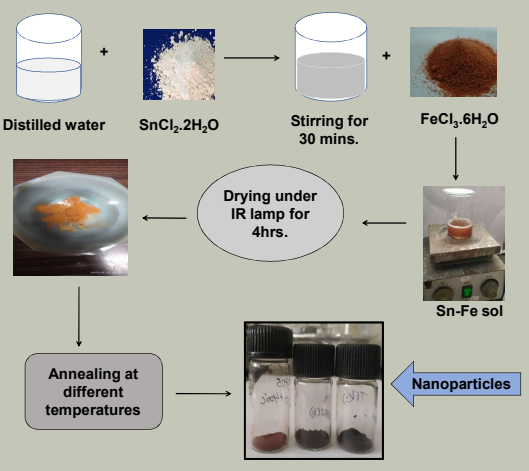
Abstract

Tin ferrite ($SnFe_2O_4$) nanoparticles have received great attention because of their unique functional properties, including an appealing electrical band structure, excellent chemical stability, high magnetization and excellent biocompatibility. $SnFe_2O_4$ nanoparticles have diverse applications including environmental remediation, lithium-ion batteries, supercapacitors and hydrogen peroxide sensors. $SnFe_2O_4$ nanoparticles were synthesized using sol-gel method. X-ray diffraction (XRD) analysis was performed to examine the structural properties of synthesized nanoparticles. $SnFe_2O_4$ nanoparticles are excellent material for electrochemical applications.

Introduction

- The term ferrite is commonly used to describe a class of magnetic oxide compounds that contain iron oxide as a principal component[1].
- Tin ferrite ($SnFe_2O_4$) is spinel oxide [2] and spinel oxides (ferrospinels or ferrites) are of considerable interest due to their diverse applications in optical, electronic, catalytic and magnetic materials [3].
- In the last few years, tin ferrite is gaining a lot of importance due to its non-toxicity, low cost, and environment friendliness[4].
- Tin ferrite is superparamagnetic material with very high magnetization and corecivity [5].

Experimental Setup



XRD Micrograph

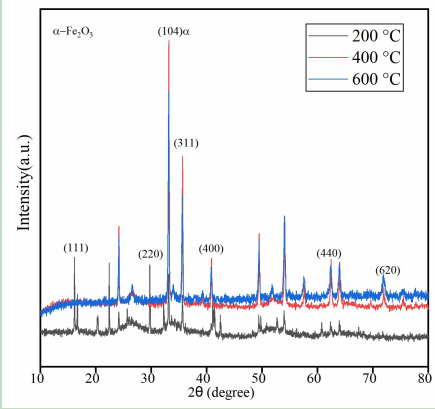


Fig 1: XRD micrograph of tin ferrite nanoparticles at three different temperatures i.e. 200, 400, and 600 °C.

Cyclic Voltammogram

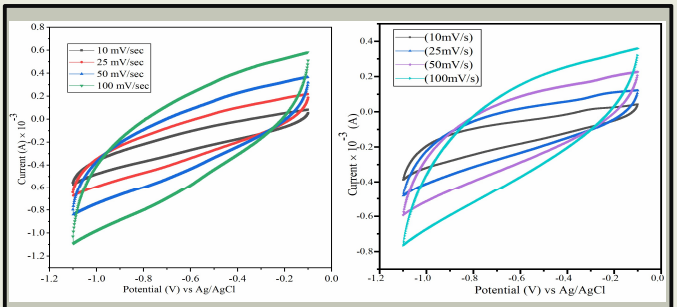


Fig 2: Cyclic voltammograms of tin ferrite nanoparticles at different scan rates (a) using 0.5M NaOH electrolyte, (b) using 0.5M Na_2SO_4 electrolyte.

Conclusions

- The XRD micrograph shows the phase formation of tin ferrite nanoparticles at 35.55°. However, there are some extra peaks in the micrograph. The peak at 33.4° represents the presence of a hematite phase due to the oxidation of nanoparticles.
- Fig 2. represents the cyclic voltammograms of tin ferrite nanoparticles with different scan rates. Both figures show that a scan rate of 100 mV/s gives the highest capacity for the tin ferrite nanoparticles.
- Among the different electrolytes tested, 0.5 M NaOH provides the best results.

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