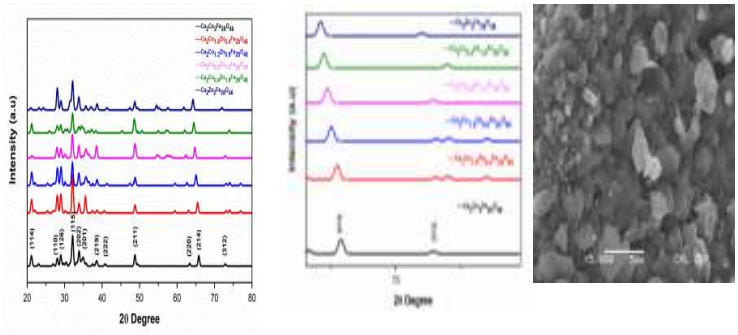
Synthesis and Characterization of Calcium substituted Cobalt $Ca_2Co_{2-x}Zn_xFe_{28}O_{46}$ X-type Hexagonal Ferrite via Sol-gel method

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Abstract

In this present work, the calcium-substituted cobalt x-type hexagonal ferrite with the composition Ca2Co2-xZnxFe28O46 (X = 0.0, 0.4, 0.8, 1.2, 1.6 and 2.0) was synthesized by the auto-combustion sol-gel method to study their structure and morphological characteristics. All prepared ferrites were dried and annealed at 150°C and 1050°C for 30 minutes and 10 hours, respectively. Structural, morphological, and electrical properties were studied using X-ray diffraction, Fourier transform infrared spectroscopy, Scanning electron microscopy, and dielectric characteristic techniques. XRD patterns have confirmed the single-phase x-type hexagonal structure and successful substitution of Zn and Co. In addition, the crystal size of all samples was calculated to be about 23.23 nm. Other parameters such as d-spacing, dislocation density, and lattice parameters were also calculated. FTIR spectroscopy was used to analyze the stretching and bending bonds in the synthesized sample. It also confirmed the incorporation of dopants, which was also observed in the XRD results. The morphology of the prepared nanocrystals was examined by scanning electron microscopy. It can be seen from the SEM image that the Ca2Co2-xZnxFe28O46 crystals have a hexagonal and platelet-like structure. One of the samples showed a nanorod-like morphology. Dielectric characterization has revealed improved conductivity of doped samples than pure. All characterizations have exposed enhanced structural, morphological, and electrical properties, which make it suitable for the wide range frequency technological applications.

Image



Flow chart for the synthesies of nanocomposites

Recent Publications

1. Mujahid Mustaqeem, Khalid Mahmood, Tawfik A. Saleh, Aziz ur Rehman, Muhammad Ahmad, Zaheer Abbas Gilani, Muhammad Asif (2020), Synthesis of CuFe2–xErxO4 nanoparticles and their magnetic, structural and dielectric properties. Physica B: Condensed Matter 588: 412176.
2. Warda Hassan, Sajida Noureen, Mujahid Mustaqeem, Tawfik A. Saleh, Shagufta Zafar (2020), Efficient adsorbent derived from Haloxylon recurvum plant for the adsorption of acid brown dye: Kinetics, isotherm and thermodynamic optimization. Surfaces and Interfaces 20: 100510.
3. Mujahid Mustaqeem, Tawfik A. Saleh, Aziz ur Rehman, Muhammad Farooq Warsi, Azhar Mehmood, Adnan Sharif, Shahbaz Akther (2020), Synthesis of Zn0.8Co0.1Ni0.1Fe2O4 polyvinyl alcohol nanocomposites via ultrasound-assisted emulsion liquid phase. Arabian Journal of Chemistry. 13:3246-3254.
4. Tawfik A. Saleh, Saddam A. AL-Hammadi, Ibrahim Munkaila Abdullahi, Mujahid Mustaqeem (2018), Synthesis of molybdenum cobalt nanocatalysts supported on carbon for hydrodesulfurization of liquid fuels. Journal of Molecular Liquids. 272:715-721.
5. Z. A. Gilani, M. S. Shifa, A. D. Chandio, m. N. Usmani, H. M. N. Ul huda K. Asghar, S. Aslam , M. Khalid, A Perveen, J. Ur rehman, Mujahid Mustaqeem, M. A. Khan (2018), Thermogravimetric analysis, optical and dielectric properties of newly developed LiNi0.5PrxFe2−xO4 nanocrystalline ferrites. Digest Journal of Nanomaterials and Biostructures, 13:809-816.



Biography

Mujahid Mustaqeem from Pakistan, PhD Scholar at academia Sinica Taiwan, National Taiwan University (NTU), with multidisciplinary background in material chemistry, Nano chemistry and analytical chemistry. My goal is to become an independent researcher and leader in the field of advanced materials for energy storage/generation applications. My research mainly focuses on areas: synthesis of nanomaterials, nanocompositte and Lithium Ion Batteries, and their applications in energy storage and generation.

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