THERMAL DECOMPOSITION OF ACETYLACETONATE PRECURSORS AS A ROUTE TO MONODISPERSE SUPERPARAMAGNETIC $NiFe_2O_4$ NANOCRYSTALS

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Phase-pure nickel ferrite ($NiFe_2O_4$) nanocrystals were obtained *via* an optimized thermal decomposition route employing acetylacetonate precursor complexes. The structural, morphological, and magnetic properties of the resulting powder were examined by X-ray powder diffraction (XRPD), Fourier-Transform Infrared Spectroscopy (FT-IR), and Transmission Electron Microscopy (TEM). Single-phase spinel formation was confirmed, and TEM analysis revealed polygonal nanoparticles with a mean diameter of approximately 7.5 nm. The close agreement between crystallite sizes derived from XRPD and grain sizes from TEM imaging is consistent with the monocrystalline character of the particles, pointing to a highly controlled nucleation and growth process. Magnetic measurements demonstrated superparamagnetic behavior under ambient conditions, with the magnetic response showing marked sensitivity to external fields and measurement conditions — a direct consequence of the narrow size distribution achieved through this synthetic approach. These findings establish organic-phase thermal decomposition as an efficient strategy for producing monodisperse $NiFe_2O_4$ nanoparticles with well-defined superparamagnetic properties, positioning them as promising candidates for magnetically responsive biomedical applications.

To advance the understanding of the structural and magnetic properties of the nickel ferrite system, Small-Angle Neutron Scattering (SANS) experiments have been planned to be performed.

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