Influence of synthesis on Fe^{2+} relative content in $(Fe^{3+})[Fe^{2+}_{1-3\delta}Fe^{3+}_{1+2\delta}\square_{\delta}]O_4$ particles of various mean diameter

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The effect of synthesis route on the stoichiometry of Fe_3O_4 with spinel structure and its ^{57}Fe hyperfine parameters was investigated by means of low temperature Mössbauer spectroscopy (MS) in fields up to 6 Tesla. While magnetite structure is stable for bulk samples, high specific surface of nanoparticles allows quick oxidation during the synthesis and/or after exposure to oxygen-rich environment, thus yielding mixed maghemite/magnetite (non-stoichiometric) samples. The nanoparticles (NPs) in this study were synthetized by thermal decomposition in high-boiling point solvents. The particles' morphology and size distribution as observed via TEM corresponded well to the log-normal distribution with mean diameter d_0=11.3 nm. As-prepared (in oil) and purified NPs showed differences in MS spectra. The comparison with the spectra of ~50-100nm and polycrystalline microscopic particles suggested that the protective oily environment stabilized the magnetite NPs for prolonged period.

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