SILICA COATED MONODISPERSE COBALT-ZINC FERRITE NANOPARTICLES FOR MRI

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Abstract
The possible use of monodisperse cobalt-zinc ferrite cores as the contrast agent for magnetic resonance imaging is investigated. The precise control of the magnetic properties can be facilitated employing strictly monodisperse cores of well-defined size and composition. Coating by silica can improve colloidal stability and applicability of the cores in biological environment.

The nanoparticles of Co$_{1-x}$Zn$_x$Fe$_{2+y}$O$_4$ with $x = (0, 0.6)$ were synthesized by thermal decomposition of corresponding acetylacetonates in a high boiling solvent. The shape and size of the particles influenced by both the temperature program and concentration of acetylacetonates and surfactants. The silica coating was carried out by the reverse microemulsion method, followed by purification and size fractionation of the product.

The XRD analysis revealed the spinel structure of the product. The mean size of crystallites $d_{XRD} = 7 - 23$ nm was comparable with the size observed by TEM, indicating the particles are single crystallites. The chemical composition of the cores was analyzed by means of XRF. Magnetic measurements showed high magnetization of the samples. Successful silica coating of the cores with the shell of the thickness $≈ 10$ nm was evidenced both by TEM and IR spectroscopy. The colloidal stability was confirmed by the method DLS.

Finally, basic viability tests were carried out using HeLa cells and preliminary relaxometric studies were focused on the possible use of the particles as T2 contrast and labeling agents for MRI.

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