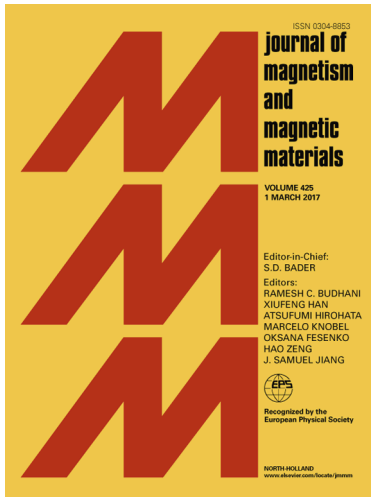

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S. Fatemeh Shams, Mehrdad Kashefi, Carolin Schmitz-Antoniak

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Statistical approach of synthesize $CoFe_2O_4$ nanoparticles to optimize their characteristics using response surface methodology

S. Fatemeh Shams [1,2], Mehrdad Kashefi [1,*], Carolin Schmitz-Antoniak [2],

[1] *Department of Materials Science and Engineering, Ferdowsi University of Mashhad, 9177948974, Mashhad, Iran*

[2] *Peter Grünberg Institute (PGI-6), Jülich Research Centre, 52425 Jülich, Germany*

Abstract

The performance of magnetic nanoparticles in different applications is severely depended on their size characteristics, so the study of effective parameters on these properties can play significant roles in qualifications of nanoparticles. In present work, some important factors on size features of $CoFe_2O_4$ superparamagnetic nanoparticles include the mixing order of synthesis components, the utilized reduction agents, stabilization process, and chelating mechanisms were investigated. Moreover, in order to optimize several influential factors such as the temperature, pH, and cation ratio of reaction, the experimental design was done by using central composite design method of response surface methodology. The simultaneous effects on the particles size and their size distribution were investigated by different methods i.e. dynamic light scattering, X-ray diffraction, Fourier transform inferred spectroscopy, vibration sample magnetometer, and transmission electron microscopy. Results demonstrated the mixing order of reduction agent to salt solution and also the employing of NH_4OH as a reduction agent could cause to significant decreasing of particles size and size distribution. Furthermore, the nitric acid could stabilize and chelate nanoparticles more appropriate than citric acid. Based on the optimization results, the quadratic polynomial models were fitted on the responses which could predict their amounts, while temperature, pH, and their interactions had higher effectiveness. In addition, the optimum amounts of particle size (14 nm) and size

[*] ***Corresponding Author:*** *Tel.: +985138806057; Email: m-kashefi@um.ac.ir (M. Kashefi), Tel.: +49 30 8062-14779; Email: f.shams@fz-juelich.de (S.F. Shams).*