BOOK of ABSTRACTS

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Engineering Multi-Core Flower-like Magnetic Nanoparticles with High Intrinsic Loss Power

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In the last decades, self-heating magnetic nanoparticles (MNPs) were engineered and investigated for magnetic hyperthermia (MH) and other applications such as catalysis and chemical synthesis. To be applied as nanoheaters for *in vivo* MH in cancer therapy, MNPs should have high heating efficiency expressed by Intrinsic Loss Power (*ILP*). One of the requirements for *in vivo* applications of MNPs is their non-toxicity. Hence, the most investigated MNPs for MH are based on iron oxides (magnetite and maghemite), which are non-toxic or slightly toxic. This work aimed to apply thepolyol-mediated protocol to engineer mixed $Zn_{1-x}Mn_xFe_2O_4$ and analyze their heating abilities. To obtain a series of $Zn_{1-x}Mn_xFe_2O_4$ samples with a specific nominal composition, the initial components, salts of Zn, Mn and Fe, were mixed in the appropriate stoichiometric ratio. The deviation from the target stoichiometry and the formation of samples with polyvalent ions and possibly vacancies were determined after ICP analysis. By analyzing TEM micrographs, we found that the change in the chemical composition does not affect the morphology. Multicore flower-like nanostructures with a size in the range of 47-63 nm were obtained. They consist of many cores (crystallites or nanoparticles) with a size of ~10 nm. The samples show good colloidal stability, which is significant for their medical applications. Magnetization measurements in different DC fields showed that the samples are superparamagnetic at 300K and that the saturation magnetization values are in the range of ~59-73 emu/g. The hyperthermic efficiency of the synthesized samples was tested in an external ac field of 252 kHz and a field strength of 15.9 kA/m. Significantly different values were obtained for the *ILP* parameter (in units nHm^2/Kg): 5.77 ($Zn_{0.098}Mn_{0.447}Fe_{2.455}O_4$) > 3.22 ($Mn_{0.624}Fe_{2.376}O_4$) > 2.04 ($Zn_{0.182}Mn_{0.344}Fe_{2.474}O_4$) > 1.36 ($Zn_{0.309}Mn_{0.240}Fe_{2.451}O_4$) > 1.01 ($Zn_{0.394}Mn_{0.138}Fe_{2.468}O_4$) > 0.34 ($Zn_{0.640}Fe_{2.360}O_4$). To explain the values of the *ILP* parameter, additional research is required, which includes the analysis of the influence of local defects and cation distribution on the magnetism of the investigated nanostructures. Also, significantly high *ILP* values indicate that some samples can be selected and further tested for *in vitro/in vivo* applications.

Keywords: magnetic nanoparticles, polyol synthesis, nanoflowers, magnetic hyperthermia.