Contribution ID: **5** Contribution code: **S06-CMPSP-210** Type: **Poster presentation**

Magnetic Hyperthermia Potential of Colloidal Zinc-substituted Iron Oxide Nanoparticles and TiO2@Zinc Ferrite Hybrids

Tuesday 30 August 2022 18:00 (1h 30m)

Iron oxide based magnetic nanoparticles (Fe3O4, *gamma*-Fe2O3), are widely investigated in biomedicine, especially as diagnostic and therapeutic agents. They can be used as imaging contrast agent, drug-delivery nanocarriers, intracellular hyperthermia mediators, etc. If their size is in the range of 4-28 nm, they show *superparamagnetic* behavior, with magnetic saturation comparable to that of a ferromagnet but with zero coercivity and remanence.

A suspension of superparamagnetic nanoparticles (SPIONs) has ability to generate heat when they are exposed to an externally applied alternating (AC) magnetic field, what has been explored for *magnetic fluid hyperthermia* treatment of a malignant tissue [1]. Local increase of tissue temperature (previously loaded with SPIONs) can cause irreversible damage of a pathologic object. There are several physical processes which govern the transformation of magnetic to thermal energy. For SPIONs losses are mainly induced by Brownian and Néel processes. The amount of generated heat power, expressed by the *specific absorption rate* (*SAR*) value [1], depends on the chemical composition, size, shape anisotropy in nanoparticles, as well as on aggregation and coating of SPIONs.

In this work we studied magnetic hyperthermia potential of two samples consisting of nanosized, oleic acid (OA)-coated zinc ferrite particles with pronounced shape anisotropy [2]. The samples were synthesized by thermal decomposition method. The heating ability of octahedral 18nm-sized Zn0.13Fe2.87O4 NPs and pebbles-like in shape Zn0.6Fe2.4O4 NPs with size ranging from 7 to 30 nm, were studied in a medium with low viscosity. The *SAR* values were evaluated for frequency, f–range (252-808) kHz and the AC magnetic field amplitude, H0-range (100-300) Oe. Hydrophobic Zn0.6Fe2.4O4 nanoparticles underwent a double-treated procedure with titania dioxide, when hybrid structures composed of magnetic nanoparticles homogeneously dispersed inside photocatalytic TiO2 phase (amorphous or crystalline), were obtained. TEM, XRD, ATR-FTIR and Mössbauer spectroscopy, as well as magnetic measurements by SQUID, were used to characterize samples.

References

1. S. Laurent, S. Dutz, U. O. Häfeli, M. Mahmoudi, Magnetic fluid hyperthermia: Focus on superparamagnetic iron oxide nanoparticles, *Adv. Colloidal Interface Sci.***166** (2011) 8-23.
2. N. Jović Orsini, M. M. Milić and T. E. Torres, Zn- and (Mn, Zn)-substituted versus unsubstituted magnetite nanoparticles: structural, magnetic and hyperthermic properties, *Nanotechnology* **31** (2020) 225707

Primary author: Dr JOVIĆ ORSINI, Nataša ("VINČA"Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia)

Co-authors: Dr MILIĆ, Mirjana M. ("VINČA"Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia); Dr MARIĆ, Tijana (Department of Health Technology, DTU Health Tech, Technical University of Denmark, 2800 Kgs., Lyngby, Denmark); Ms DANILOVIĆ, Danijela ("VINČA"Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia); Prof. GOYA, Gerardo F. (Instituto de Nanociencia de Aragón and Departamento de Fisica de la Materia Condensada, Universidad de Zaragoza, Mariano Esquillor s/n, E-500018, Zaragoza, Spain)

Presenter: Dr JOVIĆ ORSINI, Nataša ("VINČA"Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia)

Session Classification: Poster session

Track Classification: Scientific Sections: S06 Condensed Matter Physics and Statistical Physics