MME SEE
CONGRESS 2023

5th Metallurgical & Materials Engineering Congress of South-East Europe

Trebinje, Bosnia and Herzegovina

7-10th June 2023

BOOK OF ABSTRACTS

MME SEE

CONGRESS 2023

5th Metallurgical & Materials Engineering Congress of South-East Europe
Trebinje, Bosnia and Herzegovina
7-10th June 2023

BOOK OF ABSTRACTS

Main Organizer

The Association of Metallurgical Engineers of Serbia

Co-organizers

Institute for Technology of Nuclear and Other Mineral Raw Materials in Belgrade, Serbia;
The Faculty of Technology and Metallurgy at the University of Belgrade, Serbia;
The Faculty of Technology at the University of Banja Luka, Bosnia and Herzegovina;
The Faculty of Metallurgy at the University of Zagreb in Sisak, Croatia;
The Faculty of Natural Sciences and Engineering at the University of Ljubljana, Slovenia;
The Faculty of metallurgy and technology at the University of Podgorica, Montenegro.

BOOK OF ABSTRACTS - MME SEE 2023
5th Metallurgical & Materials Engineering Congress of South-East Europe

Editors:

Dr. Miroslav Sokić,
Institute for Technology of Nuclear and Other Mineral Raw Materials

Dr. Branislav Marković
Institute for Technology of Nuclear and Other Mineral Raw Materials

prof. Dr. Vaso Manojlović
Faculty of Technology and Metallurgy, University of Belgrade

Technical editor:

M. Sc. Gvozden Jovanović
Institute for Technology of Nuclear and Other Mineral Raw Materials

Published and printed by:

Association of Metallurgical Engineers of Serbia (AMES)
Kneza Miloša 9/IV,
11000 Belgrade
Serbia

For the publisher:

AMES president Dr. Miroslav Sokić

Circulation:

120 copies

ISBN 978-86-87183-33-9

MULTICORE FLOWER-LIKE MAGNETITE FOR POTENTIAL APPLICATION IN CANCER NANOMEDICINE

Miloš Ognjanović[1], Biljana Dojčinović[2], Dalibor Stanković[1,3], Marija Mirković[1], Sanja Vranješ-Đurić[1], Bratislav Antić[1]

e-mail: miloso@vin.bg.ac.rs

1-University of Belgrade, VINČA Institute of Nuclear Sciences-National Institute of the Republic of Serbia, Belgrade, Serbia, 2-Institute of Chemistry, Technology and Metallurgy, National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia, 3-Faculty of Chemistry, University of Belgrade, Belgrade, Serbia

Nanomaterials are intensively researched both from the fundamental aspect due to new properties at the nanoscale, as well as the aspect of their application in many areas of technology. Magnetic nanoparticles (MNPs) are being tested for use in the diagnosis and therapy of diseases. A new field of medicine, Magnetic nanomedicine is primarily based on the application of MNPs as drug carriers, diagnostic agents in Magnetic Resonance Imaging (MRI) and heat generators in magnetic hyperthermia. Among nanoparticles, magnetic nanoplatforms based on iron oxides for cancer diagnosis and therapy (Cancer nanomedicine) are the most researched and clinically tested. This study presents the results of research into the physicochemical properties of iron oxide nanoparticles prepared by the polyol route, as well as their testing for potential applications as agents in magnetic hyperthermia (MH) and radionuclide carriers (vectors) for the diagnosis and therapy of malignant diseases. Multicore iron oxide structures synthesized by the "polyol" method represent clusters of single-core nanoparticles or crystallites. The dimensions of the single core particles are ~13.5 nm, while the nanoflowers formed by clustering are ~25 nm, depending on the applied synthesis parameters. For targeted medical applications, nanoflowers are coated with different ligands in order to increase colloidal stability and biocompatibility. The best results were by coating MNPs with polyacrylic acid (PAA). The multifunctionality of nanoflowers was investigated by measuring their hyperthermic efficiency for applications in magnetic hyperthermia and radiolabeling with diagnostic (^{99m}Tc) and therapeutic radionuclides (^{177}Lu, ^{90}Y). In addition to traditional methods of cancer therapy (surgery, radiotherapy, and chemotherapy), new ways of therapy such as MH are constantly being developed. MH is a therapy based on the property of MNPs that when placed in an alternating (AC) magnetic field, transform the electromagnetic energy of the field into heat. When located inside a tumor, MNPs can locally generate a temperature of 42-46 °C and destroy cancer cells by heat. The hyperthermic efficiency of MNPs is expressed through the Intrinsic Loss Power (*ILP*) parameter. The measured *ILP* was 7.3 nHm^2/kg which is considered one of the higher reported values found in the literature for iron oxides. Nanoflowers were radiolabeled with ^{99m}Tc, ^{177}Lu, and ^{90}Y radionuclides. The *in vitro* stability of radiolabeling was investigated. Good *in vitro* stability indicates that the formed radioactive particles can be used simultaneously for bi-modal cancer therapy (MH and radionuclide therapy) or for MH therapy and diagnostics (theranostics), in the case of labeling with ^{99m}Tc.

Keywords Cancer nanotechnology, magnetic nanoparticles, iron oxide, microstructure