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Editorial

Special Issue on Nano- and Biomagnetism

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Magnetism in nanometer range [1] in the field of materials and biomaterials is very important, both from a fundamental point of view and, especially, when applied for their great potential with regards to the advancement of nano- and biotechnology, as well as the development of knowledge in the context of a modern society. Today, this field is in an explosive development as a result of new discoveries and innovations in the field of nanostructured magnetic materials and biomaterials, whose properties are different from those of the bulk material [2,3]. From this major differentiation, high potential for this field results, and it has, from the point of view of applications, the most diverse areas that areed targeted, starting from nanotechnology and up to bionanotechnologies and nanomedicine, including alternative cancer therapy through magnetic hyperthermia using nanoparticles.

This Special Issue has the purpose of collecting and presenting, in the form of articles and reviews, current results from research in this field, both theoretical and experimental and applied.

Thus, Grumezescu et al. [4] presents an interesting review on unexpected ferromagnetism in materials without partially filled d or f bands (d^0 magnetism), such as non-magnetic oxides, hexaborides, and carbon nanostructures, with promising applications in spintronics. Another topic of great current interest is molecular magnetism, and Ehrmann and Blachowicz [5] present a rigorous overview of the basic aspects regarding the recent advances in molecular nanomagnets, starting with single-molecule magnets (0D), going further to single-chain magnets (1D), and finally higher-dimensional molecular nanomagnets, with possible applications in information storage or magnetic labels for biosensing and as hyperthermia agents. Di Corato et al. [6] shows, through a concise review, the particular applications in nanomedicine of manganese–zinc ferrite nanoparticles, and interest in this field is known to be more concerned with iron oxide nanoparticles. Due to the small size of the nanoparticles below 20 nm, they change their magnetic behavior to superparamagnetism compared to ferrimagnetism for the bulk material, and they also present a single domain nanostructure, which makes them suitable for biomedical applications, such as magnetic hyperthermia (MHT), magnetic resonance imaging (MRI), magnetic particle imaging (MPI), magnetic-guided drug delivery, or integrated biosensors [7,8]. By changing the Mn/Zn ratio from $Mn_xZn_{1\text{-}x}Fe_2O_4$ nanoparticles (x is manganese ion concentration), biocompatibilized by coating with different organic agents, better properties can be obtained for magnetic hyperthermia of cancer or MRI, as shown by recent in vitro and in vivo studies [9,10]. An overview of current strategies and innovative technological approaches on magnetism in dentistry and also biocompatible SPIONs (superparamagnetic iron oxide nanoparticles) in biomedicine and regenerative medicine to improve hard tissue regeneration using the magnetic field and magnetic nanoparticles, which have a strong influence on cell fate, is presented by Russo et al. [11].

Additionally, in this Special Issue, current results from research in this field are shown. Thus, Caizer [12] presents the results of a theoretical study on the possible use of ferrimagnetic $CoFe_2O_4$ nanoparticles with a size of 5.9–6.7 nm in superparamagnetic hyperthermia for alternative cancer therapy through intracellular hyperthermia, analyzing

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the maximum specific loss power in nanoparticles when applying an alternating magnetic field with a frequency of hundreds of kHz. For the admissible biological limit (for which there is no damage to healthy cells) [13], it is shown that the temperature of 43 °C required in the magnetic hyperthermia of tumors can be obtained in a short time, and thus these nanoparticles can be used successfully for cancer therapy by means of superparamagnetic hyperthermia, under optimal conditions, more effectively than in the case of using γ-Fe_2O_3 or Ni-Zn-Fe ferrite nanoparticles [14,15]. Two other studies are presented by Tahoon et al. [16,17] regarding the removal of arsenic ions (As(V) and As(III)) from water using magnetic Fe_3O_4/CS/PEI (CS is chitosan and PEI is polyethylenimine) nanocomposite-having core–shell nanostructures [16], as well as the degradation of organic dyes using laccase-immobilized magnetic nanoparticles ($CuFe_2O_4$ and Fe_3O_4 nanoparticles) for industrial applications [17].

The research in the field of nano- and biomagnetism continues today at an accelerated pace due to the increased interest in this field, which has a huge potential in future advanced nanotechnologies and bionanotechnologies

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