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Magnetic, microstructure and antimicrobial investigation of Fe3O4/ZnO nano-powder and film synthesized by sol/gel and solvent evaporation in a vacuum methods

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Different coatings in various ways on magnetite nanoparticles increase their application such as the photocatalyst. In this research, Fe_3O_4 nanoparticles were covered in two different ways, sol/gel (sample S_1) and solvent evaporation in a vacuum rotary device (sample S_2). According to XRD patterns, ZnO peaks in the sample S_2 to S_1 due to film and layers formation on magnetite nano particle has increased. While in the sample S_1 core/shell structure has been formed. These results were consistent with FE/SEM and TEM (core/shell structure of S_1) images. Results of magnetic properties by VSM showed, on one side, all three samples (magnetite M, S_1 and S_2) have superparamagnetic properties, on the other side; this parameter has a direct relationship with coating process. The magnetic properties of sample S_2 to S_1 has decreased due to more dead layers of ZnO with different thickness. The antimicrobial experiments were carried out with 10^7 CFU/mL gram negative bacteria *Escherichia coli* and gram positive *bacteria Staphylococcus* aureus strains were propagated on tryptic soy agar plates. Then 20 µl of different concentration of nanoparticles suspension from 2.5-5-10-20-40-60-80 to100 mg/ml were placed on plates and incubated at 37°C for 24 h. According to the inhibition zone around film specimens, antimicrobial activity increases with increasing of the Fe_3O_4/ZnO nano particle concentration in sample S_2 to S_1. And it's more effective to staph than *E. coli* bacteria inhibition.

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Application of the BSM-SG atomic models for analysis of nuclear transmutations

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According to the Basic Structures of Matter -Supergravitation Unified Theory (BSM-SG), the near field of atomic nuclei exhibits a space micro-curvature. This effect distorts the space-time parameters of the near field, which is one of the reasons that Quantum mechanical models work only with energy levels. The re-examination of scattering experiments from this point of view reveals a complex three-dimensional nuclear structure different from the quantum mechanical models of atoms based on the Bohr atomic model. BSM-SG atomic models are one of major derivations of the BSM-SG theory. Protons and neutrons are not point-like; the atomic nuclei are with a much larger overall size, so the Coulomb barrier is not so strong. This explains the observed nuclear transmutations at accessible temperatures. The pattern of periodic table carries a strong signature of the spatial arrangement of protons and neutrons in the atomic nuclei. The nuclear spin and nuclear magnetic resonance are also identifiable features of the nuclear configuration, so they obtain a classical explanation. The BSM-SG models fit well when modeling of molecules in structural chemistry. They also provide a new opportunity for analysis and prediction of some nuclear transmutations in the field of LENR. This issue is presented in the author's book "Structural Physics of Nuclear Fusion". The book describes a new method for theoretical estimation of the binding nuclear energy based on the derived nuclear dimensions of hadrons and derived strong force parameters. This provides considerations for a proper selection of the isotopes for LENR with a lack or minimal radioactive waste.

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