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Thermosensitive magnetic nanostructured media for hyperthermia and bioimaging

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The magnetic nanoparticles show extraordinary properties such as superparamagnetism, high saturation magnetisation and heating effects related to AC losses during the magnetization reversal process of the particles. We report here development of temperature sensitive multifunctional MRI visible media that consists water dispersible superparamagnetic (Mn and Ti) doped Zn-ferrite nanocrystals coated by carboxymethylated dextran with different level of carboxyl contents. The particles produced by using sonochemical thermolysis of $Co_2(CO)_8$/$Fe(CO)_5$ and by combustion synthesis. The advantage of this technology is that the magnetic nanoparticles are specific designed to generate heating effect at the temperature up to 43°C and be MRI visible at T_2-spin-spin relaxation response. Hyperthermia used for many years to treat a wide variety of malignant tumours by capacitive heating using a microwave. Its use is based on the fact that tumour cells are more sensitive to temperature in the range of 42–45 °C (which yields necrosis, coagulation, or carbonization) than normal tissue cells (up to 56 °C). To address that challenge, we have developed MRI visible thermosensitive superparamagnetic nanoparticles that produce a sufficient amount of heat through production of eddy currents and also have a Curie temperature (T_c) sufficient to provide automatic temperature control. The T_c is a transition temperature at which particles loses magnetic response which causes eddy current flow that prevents heat generation. At T_c= 43°C the particles can enable automatic temperature control throughout a tumour because the self-regulating nature of the thermosensitive particles will correct for local variations in heat loss due to blood perfusion.

Biography

Karen S. Martirosyan is an Associate Professor in Physics and Astronomy Department at the University of Texas at Brownsville. Martirosyan's research interests are focusing on the design and fabrication of a novel advance multifunctional nano-tailored materials and devices for energy, environmental and biomedical applications. He has been the principal investigator and co-investigator for several Federal (NSF, NIH, AFRL) and State funded research projects totaling over $2M for the last 5 years. He is a fellow of 2010, 2011 Air Force Summer Faculty Fellowship. He serves on the Editorial Board of International Journal of SHS and Journal of Nanomedicine and Nanotechnology.

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