Yuko Ichiyanagi, J Material Sci Eng 2017, 6:7 (Suppl)
DOI: 10.4172/2169-0022-C1-079

Characterization and theranostics application of pluralistic ferrite nanoparticles

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Mn-Zn ferrite nanoparticles (NPs) and Co ion doped pluralistic ferrite NPs encapsulated with amorphous SiO_2 ranging several nm were prepared by our original wet chemical method. MNPs prepared by this method, Si ions are located on the surface, and this characteristic structure enables amino-silane coupling and functionalization is made easier. We have established the way of functionalization of these magnetic nanoparticles in order to conjugate other molecules. We have confirmed that our particles were introduced into the living cells, and these particles were localized by the external magnetic field. Then cancer cell selective NPs were further developed by attaching folic acid. Characterization of obtained ferrite NPs were performed by X-ray diffraction measurements, chemical analysis. Local structure of magnetic cluster was analyzed by X-ray absorption fine structure (XAFS). DC and AC magnetization measurements were performed using SQUID magnetometer. Composition and particle size were optimized for Mn-Zn ferrite nanoparticles. Samples were examined for heating agent from the result of frequency dependence and particle size dependence of imaginary part of AC magnetic susceptibilities χ". In order to estimate heating effect of magnetic nanoparticles for an application of hyperthermia treatment, increase in temperature of the samples in AC field was observed. Increase rate of temperature was found to be high enough to suppress cancer cells. Finally, *in vitro* experiment for hyperthermia treatment was carried out for the cultured cancer cells using our pluralistic ferrite samples. Human prostate cancer cells and human breast cancer cells were cultured in a dish and were exposed to an AC magnetic field. As the result, an extensive hyperthermia effect was observed. Using these NPs, MR relaxation curves were investigated. It was found that super paramagnetic behavior and smaller particles were effective for MRI contrast.

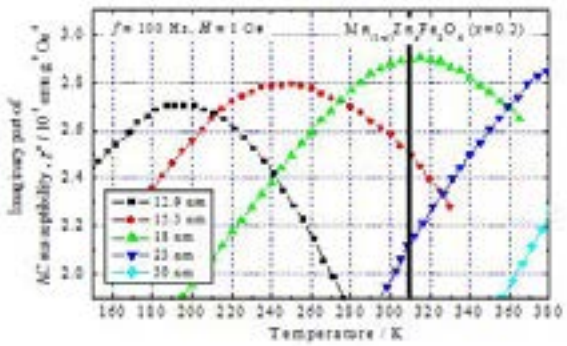

Fig.1: Imaginary part of AC magnetic susceptibility χ" of Mn-Zn ferrite nanoparticles.

Biography

Yuko Ichiyanagi has completed her PhD from Yokohama National University, Japan. She is the Associate Professor of Yokoham National University since 2009. She has published more than 30 papers in reputed journals and has been serving as an International Advisory Committee Member of some reputed conferences.

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