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Local structure analysis and biomedical applications of multifunctional magnetic nanoparticles

Yuko Ichiyanagi

Yokohama National University, Japan

Magnetic nanoparticles (MNPs) encapsulated with amorphous SiO₂ ranging several nm were prepared by our original wet chemical method. Local structure of magnetic cluster was analyzed by X-ray absorption fine structure (XAFS). 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. Mn-Zn ferrite nanoparticles were prepared and optimized in composition and particle size. To estimate heating effect of magnetic nanoparticles for an application of hyperthermia treatment, ac magnetic susceptibilities were measured and analyzed. Samples were examined for heating agent from the result of frequency dependence and particle size dependence of imaginary part of ac magnetic susceptibilities χ'' . A temperature increase of approximately 18 K was observed in a 192-Oe, 15-kHz field for Mn-Zn ferrite NPs. Increase rate of temperature was found to be high enough to suppress cancer cells. In vitro experiment showed an extensive hyperthermia effect. In addition, we have suggested out NPs as an agent of MR imaging, CT imaging, magnetic particle imaging (MPI) and mass spectrometric imaging for diagnostics. Our magnetic nanoparticles are expected to develop theranostics system.

Biography

Yuko Ichiyanagi has completed her PhD from Yokohama National University, Japan. She is an Associate Professor of Yokohama 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.

yuko@ynu.ac.jp

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