

5<sup>th</sup> International Conference on

# Theoretical, Materials and Condensed Matter Physics

November 26-28, 2018 | Los Angeles, USA



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### Characterization of ferrite nanoparticles and application for theranostics

Magnetic nanoparticles have drawn attention recently due to their interesting nanoscopic features and potential applications for not only recording electric materials but also in the biomedical field. Previously, we obtained monodisperse magnetic nanoparticles (MNPs) by an original wet chemical method and reported magnetic, structural and thermal properties. Local structure analysis by X-ray absorption fine structure (XAFS) was useful to estimate nanoscale materials. We also suggested some biomedical applications using MNPs after functionalization. These functional MNPs were further introduced into cells. Furthermore, cancer cell selective MNPs were developed. Based on these techniques, we proposed a therapeutic method of magnetic hyperthermia. Now we propose “theranostics” by development nanoparticles for diagnostic and therapeutic materials simultaneously. For the therapeutic part, several kinds of ferrite NPs were prepared and AC magnetic measurements were performed. The relationship between the imaginary part of magnetic susceptibility  $\chi''$  and the increase in temperature in the AC field was estimated. We have carried out *in vitro* experiments using cultured human breast cancer cells, and a drastic hyperthermia effect was observed. As one of the diagnostic method, mass spectrometric imaging (MSI) was proposed. With this method, the targeting analyte can be detected only with the nanoparticles as matrices, and simultaneously we can see the distribution of the materials by mapping the spectra. By means of our matrices, targeting analyte of very low molecular weight was successfully detected. Furthermore, effective parameters for MRI contrast agent, signals of the third harmonic components for magnetic particle imaging (MPI) were observed.

### Biography

Yuko Ichiyanagi is an Associate Professor at Yokohama National University since 2009 (Applied Physics) and Osaka University since 2017. She was invited and chaired at several international conferences. Now she has published more than 50 papers and books. has been serving as an International Advisory Committee Member of some reputed conferences.

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