Thesis Abstract (English)

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１．論文題目（英文）

Thesis Title (English)

Studies on Structures and Elastic Properties of Microparticles Probed by Ultrasound Scattering Techniques

２．論文要旨（英文 300 語程度）

Thesis Abstract (In approx. 300 English words)

Ultrasound spectroscopy (US) is a useful tool to investigate versatile microstructures having mechanical contrast without destruction of sample owing to low-intensity ultrasound and its sensitivity to viscoelasticity. In a transmission setup, a sample is placed between two transducers faced together to monitor the signals through the sample. When the signal is compared with that obtained without the sample as reference, the attenuation coefficient, α, and the speed of sound, *c*, can be evaluated from the difference of the amplitude and phase. Since broadband ultrasound pulses contain various frequency contributions, the dependence of the ultrasound attention and velocity on the ultrasound frequency, *f*, can be obtained by a single acquisition.

In chapter 1, Size and elastic properties of micro-particles suspended in liquid can be acoustically determined by ultrasound attenuation and velocity measurements with the aid of elastic scattering theories and a dispersion relation. While quantitative evaluation for hard micron-sized spheres using the theories is available in literature, that for hollow particles is not yet achieved. In this study, we show that the shell thickness and the elastic modulus of hollow particles can be quantitatively evaluated by ultrasound spectroscopy. Several kinds of microparticles including polystyrene rigid particles, polydivinylbenzene rigid particles, borosilicate hollow particles, and phenolic-resin hollow particles were examined. The present technique may be applied to online monitoring of soft and hard core-shell particles without dilution nor drying the sample.

Next in chapter 2, attenuation and speed of sound obtained for silica microcapsules

synthesized by interfacial polymerization of sodium silicate were studied by ultrasound spectroscopy. The experimental data were reproduced by the Waterman-Truell dispersion relation with the scattering function theory proposed by Goodman and Stern for hollow particle in liquid. The particle size distributions were successfully evaluated by the analysis and were in good agreement with those obtained by scanning electron microscope (SEM). Monitoring the formation process of such silicate microcapsules synthesized through water/oil/water emulsion as a template was also carried out.

The last work in chapter 3, the ultrasound analysis for Pickering emulsion which stabilized by localization of colloid particles at the oil/water interface. Such a structure of emulsion coated by solid particles may be regarded as a model core-shell system for ultrasound study. Therefore, in this study, the ultrasound analysis for Pickering emulsion was carried out to investigate the structure with hollow spheres model scattering theory