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Characterization of nano suspension using pulsed field gradient nuclear magnetic resonance

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There have been numerous reports on nano sized materials and investigations of the relationship between their size and physical properties. In general, commercial nanomaterials are provided as dry powder. The sizes of the primary nanoparticles are determined using the Brunauer, Emmett and Teller method or a microscopic technique. However, nanomaterials are easily aggregated in liquid phase when one want to disperse them to make novel functional application, since the high ionic nature of the solution and the electrostatic/Van der Waals interaction between nanomaterials result in secondary particles. In such a sense, the accurate characterization of the nano suspension is necessary to understand the real properties of nanomaterials in liquid phase, not only characterization of primary particles by gas-phase characterization method such as electron microscope. This study therefore concerns with characterization of the nano suspension using Pulsed Field Gradient Nuclear Magnetic Resonance (PFG-NMR) techniques. PFG-NMR spectroscopy has not been commonly employed to determine the size of nanomaterials because of the very low local reorientation mobility of hard sphere type molecules such as gold sphere. The short T2 relaxation time also makes it difficult to determine the size of hard-core materials and large molecules. However, the PFG-NMR requires no special handling or preparation of the sample. In addition, the individual self-diffusion coefficients in a multi-component system can be obtained by simultaneously monitoring NMR signals at different chemical shifts. In this study, we therefore used this PFG-NMR technique and developed the quantitative evaluation of the size of materials in nano suspension and also determine the number of bound dispersant on nanomaterials to recognize the real structure of nanomaterials in liquid phase. Since the dispersant is one of the key to disperse nanomaterials stably in liquid phase our characterization on both nanomaterials and dispersant in nano suspension by PFG-NMR should be significant in nano technological field.

Biography

Haruhisa Kato has his expertise in “Characterization of polymer and nanomaterials”. He has been investigating novel characterization instrument and method. Various nanomaterial standards (certified reference materials) are also produced by his laboratory and he is also concerned with the international standardization work in ISO/TC24, TC229 and TC256.

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