

Aggregation and dispersion control of nanoparticles, applications for various fields

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Aggregation and dispersion behavior control of nanoparticles in liquid suspension is one of the important technologies to apply nanoparticles in many fields, for examples, material, pigment, cosmetic and drug delivery systems. In this presentation, in order to develop the uniform dispersion of inorganic functional nanoparticles in organic liquid suspension, some kinds of approach were investigated by the control of surface interaction between nanoparticles based on the surface molecular and nanometer scaled structure design. In our first approach, the aggregates of inorganic oxide composite nanoparticles with different microstructure were collapsed by beads milling and particle surface was modified by silane coupling agent in organic solvent with slight amount addition of pH-controlled water simultaneously. Since composite oxide nanoparticles were prepared and collected by dry process and hydrophilic surface molecular structure, large agglomerates were formed in organic solvents. When the optimum milling and surface modification conditions were selected, 90 wt % aggregates of oxide composite nanoparticles were able to be dispersed up to primary particles. In next approach, surfactant with different molecular structure was adsorbed on the surface of uniform dispersed TiO₂ and other functional inorganic nanoparticle in aqueous suspension, the aggregates of nanoparticles were formed and precipitated in aqueous solution by the adsorption of surfactants. The separated aggregates from aqueous solution were dried and dispersed into organic solvents. If the optimum surface molecular structure was designed by the selection of molecular structure of surfactant, nanoparticles were dispersed up to primary particle in various kinds of organic solvents. Finally, the relationship between surface molecular structure and surface interaction in each organic solution was characterized by a colloid probe AFM method, and discussed the action mechanism of silane coupling agent and surfactant.