

液相析出法による水分散性酸化チタン被覆シリカナノ粒子の合成と近赤外蛍光色素の固定化

(和歌山大システム工¹・大阪技術研²) ○石飛 きらら¹・中原 佳夫¹・渡辺 充²・玉井 聡行²・矢嶋 摂子¹

Synthesis of TiO₂-Coated Silica Nanoparticles with Aqueous Dispersibility by Liquid Phase Deposition and Immobilization of Near-Infrared Fluorescent Dyes (¹*Faculty of Systems Engineering, Wakayama University*, ²*Osaka Research Institute of Industrial Science and Technology*) ○Kirara Ishitobi,¹ Yoshio Nakahara,¹ Mitsuru Watanabe,² Toshiyuki Tamai², Setsuko Yajima¹

Although the liquid phase deposition involving the generation of HF is reported as an effective coating method for nanoparticles (NPs), solvent dispersibility of the resulting core-shell NPs has been hardly discussed so far. In this study, TiO₂-coated silica NPs with aqueous dispersibility were synthesized by this liquid phase deposition method using about 50 nm of silica NPs as a starting material. An overview of the synthesis is shown in Fig. 1. First, ammonium hexafluorotitanate was added to an aqueous dispersion of silica NPs in the presence of NH₃ as a scavenger of HF and they were finely mixed at room temperature. After purification with centrifugation, water-soluble ligands such as Tiron were chemically adsorbed on the newly-formed TiO₂ layer. The high aqueous dispersibility of the obtained core-shell NPs was confirmed by dynamic light scattering. In addition, as these NPs were strongly negative-charged, cationic near-infrared fluorescent dyes could be stably immobilized on the NP surface.

Keywords : Silica Nanoparticle; Titanium Oxide; Aqueous Dispersibility; Liquid Phase Deposition; Near-Infrared Fluorescent Dye

ナノ粒子のコーティング法として、フッ化水素酸の発生を伴う液相析出法が効果的な方法として報告されているが、この方法で得られたコアシェルナノ粒子の溶媒分散性については今のところほとんど議論されていない。本研究では、粒径約 50 nm のシリカナノ粒子を出発原料として用い、この液相析出法によって水分散性の酸化チタン被覆シリカナノ粒子を合成した。合成手順の概要を、Fig.1 に示す。最初に、フッ化水素酸捕集剤としてのアンモニア存在下、ヘキサフルオロチタン酸アンモニウムをシリカナノ粒子の水分散液に加えて室温でよく攪拌した。遠心分離によって精製した後、新たに形成された酸化チタン層にタイロンなどの水溶性の配位子を化学吸着させた。得られたコアシェルナノ粒子の高い水分散性は、動的光散乱法によって確認した。また、これらの粒子は負に強く帯電したため、カチオン性の近赤外蛍光色素を粒子表面に安定に担持できた。

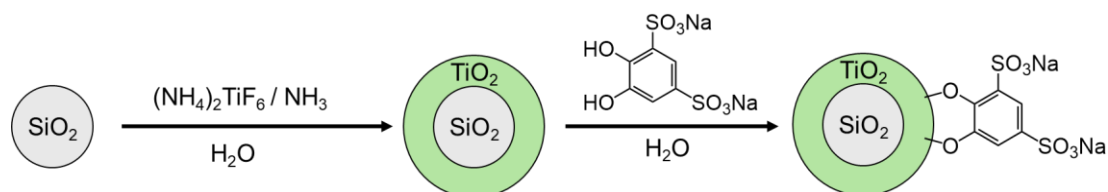


Fig.1 Synthesis of TiO₂-coated silica NPs with aqueous dispersibility.