OP 09

Synthesis of decanoic acid-modified iron oxide nanocrystals using supercritical carbon dioxide as reaction medium

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Abstract (less than 300 words)

Nanoparticle synthesis in liquid phase, such as heat-up and hydrothermal methods, has been typically applied to the preparation of organic modified nanocrystals (NCs), however, these methods cause the large amount of the liquid waste for the synthesis and washing of NCs [1, 2]. In contrast to them, supercritical CO_2 can be one of the appealing candidates to fabricate organic modified NCs because supercritical CO_2 was used as not only synthesis but also washing and drying solvent for the particle production, which enables the simple fabrication process without the liquid waste. Moreover, solvation power of supercritical CO_2 for the starting and intermediate molecule can be tuned by operating temperature and pressure, where this characteristic is expected to control the reaction for the formation of organic modified NCs.

In this contribution, we report a synthesis using supercritical CO_2 as reaction medium for organic-modified NCs. To investigate the effect of supercritical CO_2, the synthesis was performed at N_2 atmosphere and at 30 MPa of CO_2 after introducing the starting materials of iron(III) acetylacetonate, pure water and decanoic acid into the high pressure cell. The reaction time and temperature were set at 18 h and 100°C, respectively. As a result, the yield of the solid materials significantly increased by using supercritical CO_2 of 30 MPa compared with the test at N_2 atmosphere. Additionally, supercritical CO_2 medium gave the NCs of α-Fe_2O_3 and γ-Fe_2O_3 with the unimodal size distribution where the mean size was 7.8 ± 2.0 nm. Moreover, the FT-IR and TG analysis supported that decanoic acid do not physical absorb to the surface but chemically attach to the surface of iron oxide NCs obtained in supercritical CO_2.

References

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