Synthesis of organic-inorganic hybrid nanoparticles by surpercritical fluid and thermodynamics and unit operation of hybrid nanoparticles

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【Outline of survey】

Metal oxide nanoparticles are expected to be used in various applications, because theoretical prediction suggests that the hybridization of metal oxide nanoparticles with polymers, antibodies, and metal nanoparticles results in the advanced functions. However, nanoparticles are readily aggregated due to their high surface energy. On the other hand, the hybridization with other materials required designed surface chemical properties of metal oxide nanoparticles. Based on these increasing demands, we plan to develop our surface modification technique to hybridize metal oxide nanoparticles with organic molecules. We then design and control the affinity of metal oxide nanoparticles with other materials. These modified surface properties are characterized through phase behavior of metal oxide nanoparticles in liquid media. The developed technique is also used to build hetero-nanoassemblies of metal oxide and metal nanoparticles.

【Expected results】

This research allows easier handling of metal oxide nanoparticles and hybridization with other materials, which accelerate the collaborative research with other groups. The results also contribute to the fundamental knowledge of unit operation of the nanoparticles. The results also reveal the mechanism of organic-inorganic hybridization and thermodynamic aspects of surface-modified metal oxide nanoparticles.

【References by the principal investigator】

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- J. Zhang, S. Ohara, M. Umetsu, T. Naka, Y. Hatakeyama, T. Adschiri, “Coll oidal Ceria Nanocrystals: A Tailor-Made Crystal Morphology in Supercritical Water,” *Adv. Mater.* **19**, 203-206 (2007).

【Term of project】 FY2008－2012	【Budget allocation】 **152,500,000 yen** (direct cost)

【Homepage address】 http://www.tagen.tohoku.ac.jp/labo/ajiri/index-j.html