

# Synthesis and Application of a New Class of Nanomaterials

## Project Leader

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## 1. Objective

### This project is aimed at:

Investigating new aspects of inorganic nanomaterials including inorganic-organic hybrid ones and their applications in fields such as chemistry, materials, catalysts, medicine, and energy. We have succeeded in preparing spherical mesoporous metal oxide nanoparticle assemblies by means of an ultimately simple one-pot and single-step procedure with a very short reaction time. The morphologies of the nanomaterials are easily controlled by simple modification of the reaction conditions. These nanomaterials with unique morphologies and properties will enable extensive contributions to nanomaterial science.

## 2. Project Outline

### To that end, the project will consist of the following phases:

- (a) The creation of new inorganic-organic hybrid nanomaterials.
- (b) Application to catalysts for chemical reactions.
- (c) Creation of higher-order nano-composites, including nanoparticles.

## 3. Expected Performance

### In this project, the successful candidate would be expected to:

- (a) Synthesize inorganic nanomaterials and inorganic-organic hybrid nanomaterials.
- (b) Perform property analysis of nanomaterials.

## 4. Required Skills and Knowledge

### The successful candidate for this project will have the following knowledge and skills:

- (a) Knowledge and skills of inorganic chemistry, coordination chemistry, and organic chemistry
- (b) Basic knowledge and skills to operate XRD, SEM, and TEM.
- (c) Ability to characterize nanomaterials.

## References

- (1) One-step Direct Synthesis of SiO<sub>2</sub>-TiO<sub>2</sub> Composite Nanoparticle Assemblies with a Hollow Spherical Morphology, H. T. T. Nguyen, T. Habu, M. Ohtani, K. Kobiro, *Eur. J. Inorg. Chem.* **2017**, in press, DOI: 10.1002/ejic.201700253.
- (2) Three-Dimensionally Branched Titanium Dioxide with Cheek-Brush Morphology: Synthesis and its Application to Polymer Composites, F. Duriyasart, H. Hamauzu, M. Ohtani, K. Kobiro, *ChemistrySelect* **2016**, *1*, 5121–5128, DOI: 10.1002/slct.201600937.
- (3) Water-triggered Macroscopic Structural Transformation of a Metal-Organic Framework, M. Ohtani, K. Takase, P. Wang, K. Higashi, K. Ueno, N. Yasuda, K. Sugimoto, M. Furuta, K. Kobiro, *CrystEngComm*, **2016**, *18*, 1866-1870, DOI: 10.1039/C6CE00031B.

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