Design and Development of Functional Nanomaterials

Project Leader
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1. Objective

This project is aimed at the development of novel functional nanomaterials based on organic, inorganic, and polymeric materials. Taking advantage of intermolecular interaction and chemical bonding, we will attempt to create novel functional nanomaterials composed of various combinations of organic materials, inorganic materials, and macromolecules. In particular, by controlling very precisely the chemical reactions and equilibriums in terms of physical chemistry, we hope to develop a new synthetic methodology that breaks through the limitations of conventional approaches. Through this project, we anticipate the evolution of innovative, new processes for nanomaterial chemistry that will contribute to the next-generation of energy production and technology.

2. Project Outline

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

(a) Development of novel composite nanomaterials that have multi-functionality
(b) Application of the nanomaterials in catalytic chemical reactions
(c) Physical chemistry analysis of the properties and reaction mechanisms of the nanomaterials

3. Expected Performance

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

(a) Synthesize novel nanomaterials composed of organic, inorganic and polymer materials
(b) Perform a structural analysis of the nanomaterials
(c) Examine the fundamental electronic properties, photochemical properties and catalytic applications of the nanomaterials

4. Required Skills and Knowledge

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

(a) Knowledge and skills for synthetic chemistry based on organic, inorganic, and polymer chemistry
(b) Basic knowledge of, and skills for, operating TEM, SEM, and XRD to analyze the structure of nanomaterials
(c) Fundamental knowledge of electrochemistry and photochemical chemistry

References

(1) *Thermal crystal phase transition in zeolitic imidazolate frameworks induced by nanosizing the crystal*, Kaneshige, T.; Sakamoto, H.; Ohtani, M. *Chem. Commun.*, **2022**, *58*, 4588–4591. (Highlighted in "*Chemical Communications HOT Articles 2022*")
(2) *Unusual ligand substitution of a metal-organic framework with distorted metal–ligand coordination*, Sakamoto, H.; Ito, A.; Ohtani, M. *CrystEngComm*, **2022**, *24*, 1690–1694.
(3) *Impact of nanosizing a host matrix based on a metal–organic framework on solid-state fluorescence emission and energy transfer*, Sakamoto, H.; Akitaka Ito, A.; Ohtani, M. *Mater. Adv.*, **2022**, *3*, 2011–2017.

(4) *Water-triggered macroscopic structural transformation of a metal-organic framework*, Ohtani, M.; Takase, K.; Wang, P.; Higashi, K.; Ueno, K.; Yasuda, N.; Sugimoto, K.; Furuta, M.; Kobiro, K. *CrystEngComm*, **2016**, *18*, 1866–1870.

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