Title of Project : Coordination Asymmetry: Design of Asymmetric Coordination Sphere and Anisotropic Assembly for the Creation of Functional Molecules

Mitsuhiko Shionoya
(The University of Tokyo, Graduate School of Science, Professor)

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【Purpose of the Research Project】

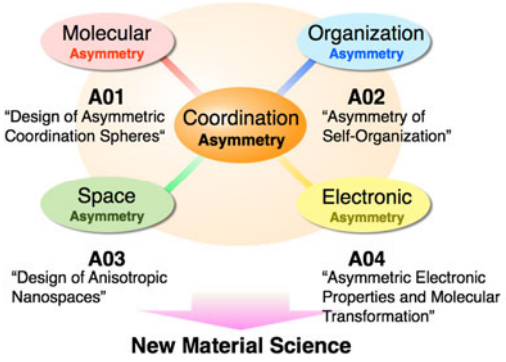
One of the final goals in chemistry is to control absolute/relative configurations of every element and to precisely design their bonding. It is therefore of key importance for developing new material science to construct metal–centered chirality and asymmetric coordination spheres.

This project aims at developing constructive methods for asymmetric coordination spheres and anisotropically assembled structures of metal complexes by theory, experiment, and instrumentation, focusing on metal elements and their coordination spheres as platforms for steric control, reactions, and functional expression. Namely, methods to create asymmetric and steric/electronic structures of metal complexes and their nano– to micron–size assembled structures will be developed by the molecule-based control of the coordination spheres to establish a scientific principle of "coordination asymmetry". In particular, constructive methods for chiral metal complexes, including asymmetric induction of prochiral metal complexes, and asymmetric assembled structures are expected to develop new molecules and materials with anisotropic and directional structures and functions. This principle would open new research comparable to asymmetric organic synthesis by making innovations for metal coordination–based advanced materials.

【Content of the Research Project】

In this research area, the following four research items collaborate closely with each other between research groups of theory, experiment, and instrumentation. A1 (molecular asymmetry): construction of asymmetric coordination spheres of metal complexes, elucidation of structure, reactivity, dynamic property of asymmetric metal complexes in solution and the solid states and at the interface. A2 (organization asymmetry): nano– to micron–size anisotropic self–assembly of coordination nanomaterials leading to assembled structure–based functions. A3 (space asymmetry): construction of asymmetric spaces based on the natures of coordination bonding directed toward amplification and dynamic control of directional and anisotropic space functions. A4 (electronic asymmetry): anisotropic assembly of coordination compounds by bridging with chiral ligands and asymmetry transfer at the interface or space directed toward asymmetric molecular transformation and chiral/directional functions.

Proposals with supportive, transversal, and applied perspectives will be openly recruited for these research items.



【Expected Research Achievements and Scientific Significance】

This project will establish a new scientific principle regarding constructive methods for coordination spheres and anisotropic assembly of metal complexes, which will result in the paradigm shift not only for coordination chemistry but also for material science. A new class of materials will be created by the precise design of absolute/relative configurations of metal complexes and their assembled materials (unit/organization design). With a view to such an essential part of chemistry and every related field, we promote this project with a principle of "coordination asymmetry".

We also focus on international collaboration between different fields leading to international network development, looking for young players to develop with a higher viewpoint and expertise.

【Key Word】

Coordination asymmetry: a scientific principle regarding constructive methods for asymmetric coordination spheres of metal complexes and their anisotropically assembled structures

【Term of Project】 FY2016-2020

【Budget Allocation】 1,168,000 Thousand Yen

【Homepage Address and Other Contact Information】

http://asymmetallic.jp
shionoya@chem.s.u-tokyo.ac.jp