

Development of New Synthetic Organic Reactions Based on the Universal Metals Catalysis

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【Outline of survey】

A number of precisely controlled organic reactions have been developed with catalysts of the 4d and 5d late transition metals such as Ru, Rh, Pd, Ir, Pt, and Au. It has been difficult to apply the well-established ligand-control strategies to the tuning of the catalytic reactivities of the much more universally abundant 3d late transition metals, which we call the universal metals. This is mainly due to the capricious intrinsic properties associated with these 3d metal elements, namely oxidation states, coordination modes, and spin states. This Research program aims at the development of new catalysts based on the universal metals for selective organic synthesis and production of functional molecules. In order to establish a general concept for the modulation of the 3d late transition metal catalysts, our initial focus is on iron as a representative universal metal. We will develop new iron-catalyzed reactions and apply them to the creation and industrial production of functional organic molecules such as organic electronic devices, liquid crystals, and pharmaceuticals.

【Expected results】

We expect the following results: 1) development of iron-catalyzed cross-coupling reactions between halo-alkanes or arenes, and organo-magnesium, zinc, aluminum, and boron reagents; 2) development of iron-catalyzed carbon-nitrogen bond forming reactions; 3) development of iron-catalyzed catalytic enantioselective C–C bond forming reactions; and 4) their demonstrative application to the industrial production of functional molecules.

【References by the principal investigator】

"Iron-Catalyzed Selective Biaryl Coupling: Remarkable Suppression of Homocoupling by the Fluoride Anion" Hatakeyama, T.; Nakamura, M. *J. Am. Chem. Soc.* **2007**, *129*, 9844-9845.

"Iron-Catalyzed Cross-Coupling of Primary and Secondary Alkyl halide with Aryl Grignard Reagents" Nakamura, M.; Matsuo, K.; Ito, S.; Nakamura E *J. Am. Chem. Soc.* **2004**, *126*, 3686–3687.

【Term of project】 FY2008– 2012

【Budget allocation】

80,500,000 yen (direct cost)

【Homepage address】

<http://es.kuicr.kyoto-u.ac.jp/>