

The collaboration research for the Dual Graduate School between VNU and JAIST

[Title of collaboration research]

Design of Nano-Structured Catalysts for Environmentally-Friendly Chemical Reactions

[The members of collaboration research]

Kohki EBITANI, Prof.

[Reference home-page address]

<http://www.jaist.ac.jp/ms/labs/ebitani/>

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Catalyst will play a pivotal role in developing our sustainable society because catalyst has a potential ability to solve the issues concerning energy, resource, and health by converting molecules to desired products under mild conditions with high atom efficiency of the chemical reaction.

The collaboration research will be directed towards the development of high-performance heterogeneous catalyst for environmentally-friendly chemical processes by designing solid surface in atomic or molecular levels. In particular, the attention of this collaboration research is focused on creation of nano-structured multifunctional catalysts through the design of catalytically active species for important reactions that contribute to solve the problems concerning energy and resources.

The purpose of the collaboration research is to create the novel heterogeneous catalysts to meet scientific challenges in combination with application-oriented research within the following four topics:

- 1) Design of Solid Acids and Bases for Efficient Carbon-Carbon Bond-Forming Reactions on Water
- 2) Creation of Surface Metal Species for Selective Oxidations of Olefin and Benzene Using Molecular Oxygen as an Ideal Oxidant
- 3) Development of Multifunctional Catalyst for Utilization of Bio-Mass and Water
- 4) Elucidation of Catalytic Potentials of Metal Nanoclusters

The structure of catalysts is characterized on the basis of expertise in a variety of experimental techniques, such as kinetic and temperature-programmed studies, chemisorption measurements, Solid-state NMR, FT-IR and UV-VIS Spectroscopies, Transmission and Scanning Electron Microscopies, X-ray diffraction. Our Institute is famous for advanced instruments. Through collaborations with facility of synchrotron radiation such as SPring-8 (Harima, Japan) we also have access to highly specialized XAFS (X-ray Absorption for Fine Structure) equipment that allows determination of the structure of catalytic materials in an atomic level.

The creation of well-defined active metal sites on a solid surface not only opens up an avenue to materials that boost catalytic performance but also aids an understanding of the molecular basis of heterogeneous catalysis. Furthermore, we expect that our achievements will exploit the way to establish the collaborations between chemistry, physics, and biology for creating the advanced and substantial materials that solve the serious social issues in the present moment.