


## Unified catalysis concepts from molecular design to sustainable chemicals and materials

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	Project Information	Project Number : 22K21348 Project Period (FY) : 2022-2028 Keywords : Catalyst, Enzyme, Sustainable materials conversion, Bioeconomy

### Purpose and Significance of the Research

#### ● Research overview and importance

Catalysts are indispensable tools for materials conversion in a sustainable economy. Conversion of inexpensive raw materials and sustainable resources into high-performance substances (polymer materials, electronic materials, pharmaceuticals, etc.) and chemical energy sources (hydrogen, methanol, etc.), and the conversion of macromolecules (plastics and biomass) into useful small molecule products through decomposition are important objectives in today's synthetic chemistry and biotechnology. The development of superior catalysts and processes that skillfully handle catalysts will be important to achieve objectives. Interdisciplinary fusion of chemistry and biotechnology is expected to yield powerful and innovative catalysts to transform the production of chemicals and materials from renewable resources. In this project, an interdisciplinary team of researchers at Osaka University and RWTH Aachen University join forces/expertise to develop new catalysts and contribute to training of the next generation of catalysis scientists.

#### ● Outline of Research

The team will focus on unifying a broad range of synthesis concepts by developing biohybrid catalysts (protein shells harboring chemical catalysis), cascade bioprocesses, small molecule conversions, computational and data science-driven catalyst design, applications of biomedical materials, and decomposition of existing chemicals and biomass. These projects are expected to contribute to the development of catalysts for a sustainable bioeconomy.

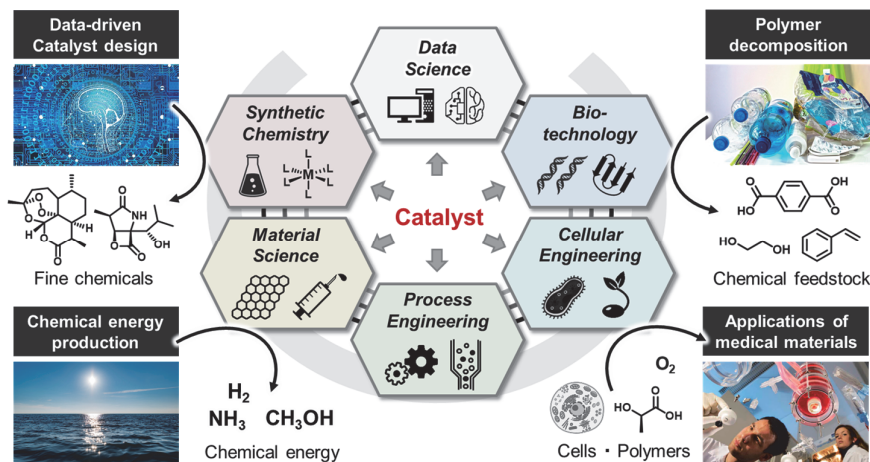


Fig.1 Representative research projects

### Organization of the Project Team

#### ● Background to this international joint research

Since 2010, Osaka University and RWTH Aachen University have conducted an educational program focusing on the exchange of graduate students in chemistry and biotechnology through the "JSPS Japan-Germany Joint Graduate School Program" and the "DFG-supported IRTG program SeleCa". The current research project focuses on promotion of joint research and development of young researchers. Most of the members of the team are under 50 years old, and will develop a long-term joint research system for the next generation.

#### ● Outline of joint research system

International joint research will be conducted by six researchers specializing in catalyst chemistry and polymer chemistry on the Osaka University side and seven researchers specializing mainly in biotechnology and computational science on the RWTH Aachen University side. Since both sides have different fields of expertise, they will bring their respective fields of expertise together to integrate the concepts of catalysis in chemistry and biotechnology based on research in different and interdisciplinary fields, and jointly aim to achieve results that will contribute to sustainable material transformation and the bioeconomy.

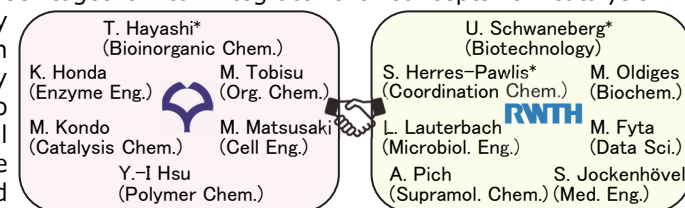


Fig.2 Collaboration team

### Plan for Fostering Early-career Researchers

#### ● Plan for fostering development of early-career researchers

A total of 12 postdoctoral researchers will be employed and sent from Osaka University to the partner laboratories of RWTH Aachen University for about two years each to promote joint research and to foster future independent researchers. In addition, about 36 doctoral students associated with the principal investigators and co-investigators will be sent to Aachen during the research period to cultivate a global sense of awareness. In return, we will host doctoral researchers and students from Aachen to Osaka.

#### ● Examples of specific initiatives

✓ "Young researchers' meetings" between Osaka University and RWTH Aachen University will be held online about three times each year by young researchers (postdoctoral researchers, students, assistant professors, etc.) who are related to this research project. Both sides will present their research contents and deepen exchanges. The facilitator will be a young researcher selected from one of the two universities.

✓ The postdoctoral researchers visiting RWTH Aachen University are recommended to attend relevant international conferences and give oral presentations during their visits at Aachen.

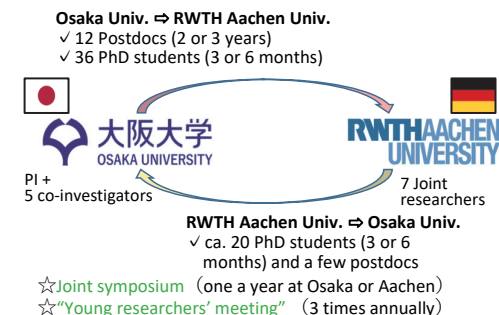


Fig.3 Personnel exchange plan