

Case Study for JSPS Core to Core project;
**Strategic solid-state chemistry for novel functional oxides:
Exploring for new materials with novel functionalities**

Principal Investigator: **Prof. Yuichi Shimakawa**, Institute for Chemical Research, Kyoto University
Other Japan Lead Investigators: **Prof. Zenji Hiroi**, Institute of Physics, University of Tokyo. **Prof. Hiroshi Kageyama**, Engineering of Department, Kyoto University

UK Lead Investigator: **Prof. J. Paul Attfield**, Centre for Science at Extreme Conditions and School of Chemistry, University of Edinburgh.

Other Lead Investigators: **Prof. Werner Paulus**, Institute Charles Gerhardt, University of Montpellier, France. **Prof. Ru-Shi Liu**, Department of Chemistry, National Taiwan University, Taiwan. **Prof. Hide Takagi**, Max-Planck-Institute for solid state research, Stuttgart, Germany

The aim of this collaboration project was to discover new oxides and related materials having interesting and useful properties. Such new materials with novel functionalities are of great interest for developing future information and energy technologies. The consortium consisted of materials chemists with common interests in materials science and solid-state chemistry. The lead investigators all have active research groups and strong records in materials science. High pressure synthesis, epitaxial thin-film growth, single crystal growth, and low-temperature topochemical reactions were used extensively in materials synthesis. Detailed structural characterizations are important parts of this international collaboration study, and large-scale synchrotron x-ray and neutron facilities in Japan, UK, France, and Taiwan, were frequently used.

Our collaboration started with a visit by Attfield to ICR-Kyoto in 2005, and further visits and exchanges led to a successful Core-to-Core proposal to JSPS in 2015. Funding by JSPS was matched from the EPSRC-UK 'Spintronics and Advanced Materials', and the other research teams also provided support. Funds were primarily used to support young researchers and students at the participating institutions, and to travel to research seminars and workshops every year.

Although the covid pandemic disrupted exchanges and travel during 2020-2022, the collaboration was highly successful with over 40 collaborative papers published. Scientific milestones highlighted included discoveries of new cation-ordered magnetic oxides and nitride electrocatalysts for water splitting.

We plan to apply for further funding through a JST international collaboration project and the new UK International Science Partnerships Fund to continue our successful collaboration.



Delegates at the 'Reconnecting Oxides Research' network meeting held near Edinburgh in March 2023. This was the final meeting sponsored through our Core to Core project.