

## Research Interests – Prof. Dr. Shigeyoshi Inoue

---

With the global demands for energy and resources ever increasing, development of sustainable methodologies is vital. One way to achieve this is to use environmentally benign and abundant metals to transform waste emissions into value added products. For example, carbon dioxide (CO<sub>2</sub>) provides a simple C1 building block, which can be converted into a variety of resources from plastics to pharmaceuticals. However, in general, this requires a metal catalyst to break the strong bonds within CO<sub>2</sub> and then control the product formation. Currently many industrial metal catalysts are based on the use of transition metals, which are typically toxic and, with their limited long-term supply, expensive. Research within the Inoue group aims to develop new catalysts based upon group 13, 14, and 15 elements with a focus on some of the most environmentally benign and abundant metals, namely silicon and aluminium.

These main group compounds have recently shown their ability to mimic transition metals through their ability to activate relatively inert bonds under mild conditions. However, in order to offer a true “eco-friendly” alternative to transition metals their catalytic potential is yet to be fully realised. One of the major focuses of Inoue’s research is to understand the key processes in enabling bond activations and catalysis with low-oxidation state main group elements. This uses a combined experimental and theoretical approach to develop our understanding of the key steps in enabling catalytic turnover. One aspect has been to study the role of stabilising ligands in low-oxidation state metal complexes, and their role in enabling oxidative addition of small molecules and substrates. Challenges still remain in reductive elimination chemistry, but recent discoveries from our group have shown it is possible to use these reactive earth abundant metals in catalysis.