

The Power of Earth-Abundant Main Group Elements: New Horizons in Bond Activations and Catalysis

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Over the last several decades, main group compounds have been at the center of some of the most exciting research in synthetic chemistry. These advances have increased our understanding of fundamental phenomena in chemistry, such as the nature of chemical bonding itself. As the field has become more established, and more is known about the characteristics of low-oxidation state main group compounds, a shift in focus towards application has gradually emerged. Areas such as materials and catalysis, which are indispensable pillars of the chemical industry, have sought particular interest in sustainable and environmentally benign alternatives to traditional processes. The use of reactive low-oxidation state main group compounds may offer a cost-efficient and non-toxic alternative to many current transition metal-based industrial processes. In this presentation, design, synthesis, isolation and reactivity of selected main group compounds (i.e. silicon, aluminium) will be described. Particularly, unique small molecule activations, bottom up synthesis of clusters, and homogenous catalysis by using earth abundant main group complexes will be presented.

References:

1. C. Weetman, S. Inoue, *ChemCatChem* 2018, 10, 4213.
2. C. Weetman, P. Bag, T. Szilvási, C. Jandl, S. Inoue, *Angew. Chem. Int. Ed.* **2019**, 58, 10961.
3. C. Weetman, A. Porzelt, P. Bag, F. Hanusch, S. Inoue, *Chem. Sci.* **2020**, 11, 4817.
4. D. Franz, T. Szilvási, E. Iran, S. Inoue, *Nature Commun.* **2015**, 6, 10037.
5. D. Franz, C. Jandl, C. Stark, S. Inoue, *ChemCatChem* 2019, 11, 5281.
6. D. Sarkar, L. Groll, D. Munz, F. Hanusch, S. Inoue, *ChemCatChem* **2022**, 14, e202201048.
7. D. Sakar, C. Weetman, S. Dutta, E. Schubert, C. Jandl, D. Koley, S. Inoue, *J. Am. Chem. Soc.* **2020**, 142, 15403.
8. D. Reiter, R. Holzner, A. Porzelt, P. Frisch, S. Inoue, *Nature Chem.* **2020**, 12, 1131.
9. F. S. Tschernuth, T. Thorwart, L. Grrreb, S. Inoue, *Angew. Chem. Int. Ed.* 2021, 60, 25799.
10. F. S. Tschernuth, L. Bichlmaier, S. Inoue, *ChemCatChem* **2023**, 15, e202300281.
11. S. Fujimori, A. Kostenko, R. Scopelliti, S. Inoue, *Nature Syn.* 2023, DOI: 10.1038/s44160-023-00283-w.
12. L. Moritz, D. Franz, A. Espinosa, M. Bolte, F. Hanusch, S. Inoue, *Nature Chem.* 2023, in press.



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Prof. dr. Shigeyoshi Inoue studied chemistry at the University of Tsukuba (Japan), earning B.Sc and M.Sc. under the supervision of Prof. Dr. Akira Sekiguchi and he remained in the Sekiguchi group to carry out his doctoral studies, obtaining his Ph.D. in 2008. As an Alexander von Humboldt grantee as well as a JSPS grantee, he spent the academic year 2008-2010 at the Technical University of Berlin in the group of Prof. Dr. Matthias Drieß. In 2010 he established an independent research group as a Sofja Kovalevskaja Professor at the Technical University of Berlin. Since 2015 he has been on the faculty at the Technical University of Munich, where he holds a professorship of silicon chemistry.

His current research interests focus on the synthesis and reactivity study of compounds containing low-valent/oxidation state main group elements with unusual structures and unique electronic properties, with the goal of finding novel applications in synthesis and catalysis. A particular emphasis is placed on low-valent silicon and aluminium compounds.

He has received several awards including the Sofia Kovalevskaja-Award 2010 (Alexander von Humboldt-Foundation), ADUC-Prize 2011 (GDCh), The Chemical Society of Japan Award for Young Chemists 2015, Carl-Duisberg- Memorial Prize 2017 (GDCh) and NISTEP Award 2018 (the Ministry of Education, Culture, Sports, Science and Technology, Japan), and Eugen und Ilse Seibold Prize 2020 (DFG). He is also the recipient of ERC Starting Grant 2014 and ERC Consolidator Grant 2020, Japan Society for the Promotion of Science Prize (2022) and WACKER Silicone Award (2023).

He is an author of more than 160 articles, which were cited above 7000 times (h-index: 51 (Scopus)).