

Air-stable and Highly Active Metal Phosphide Catalysts for Green Sustainable Reductive Molecular Transformations

Takato Mitsudome (Osaka University)

mitsudom@cheng.es.osaka-u.ac.jp

Abstract

In our quest for green and sustainable chemical processes, we have explored the use of air-stable and highly active transition metal phosphide catalysts for molecular transformations [1]. Although transition metal phosphides have been reported as attractive electrode catalysts in hydrogen generation reactions, their potential for catalytic molecular transformations in the liquid phase remains largely unexplored. Our efforts have led to the discovery that nanosized non-precious metal phosphides function as highly efficient heterogeneous catalysts for various reductive molecular transformations. Unlike traditional air-unstable non-precious metal catalysts, non-precious metal phosphides are stable in air, eliminating the need for strict anaerobic conditions or pre-reduction. Moreover, when combined with supports, metal phosphides exhibit significantly enhanced activity, offering new insights and possibilities for green and sustainable molecular transformations. I will present some representative achievements of non-precious metal phosphides, especially focusing on the iron phosphide catalyst.

References

[1] T. Mitsudome et al, *Nat. Commun.*, **2023**, 14, 5959; *ACS Catal.*, **2023**, 13, 5744; *JACS Au*, **2022**, 2, 419; *JACS Au*, **2021**, 1, 501; *Sci. Rep.*, **2021**, 11, 10673; *ACS Sustainable Chem. Eng.*, **2021**, 9, 11238; *ACS Sustainable Chem. Eng.*, **2021**, 9, 6347; *ACS Catal.*, **2021**, 11, 750; *Chem. Eur. J.*, **2021**, 27, 4439; *Green Chem.*, **2021**, 23, 2010; *Chem. Sci.*, **2020**, 11, 6682; *ACS Catal.*, **2020**, 10, 4261.



Education and degrees: Takato Mitsudome received his Ph.D. (2006) from Osaka University, where he was supervised by Prof. Kiyotomi Kaneda. After obtaining his Ph.D., he joined the group of Profs. Kiyotomi Kaneda and Koichiro Jitsukawa as an assistant professor in 2007 in the Graduate School of Engineering Science at Osaka University, and was promoted to an associate professor in 2016. His research interest is the design of nano-structured heterogeneous catalysts for environmentally benign and selective molecular transformations. He has published more than 150 papers in reputed journals.

Awards: 17th Green & Sustainable Chemistry (GSC) Encouragement Award (Japan Association for Chemical Innovation), Osaka University Award (Young Professor Section), Catalysis Society of Japan Award for Young Researchers, Young Scientist Award (15th International Congress on Catalyst)