Catalytic Hydrogen Management for Renewable Feedstock: Hydrogenation under Dark and Dehydrogenation under Light

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In view of strong requirement of manufacturing sustainability complementary to fossil resources, renewable feedstock such as CO_2, amides, carboxylic acids, and esters are ubiquitous and abundant in the nature/our surroundings. Reduction including hydrogenation of those inert compounds in high oxidation states of carbon could provide new platform chemicals constituting alcohol diversity that leads to fine chemicals. How do we use alcohols obtained thereof in the next generation chemical transformations? Given the alcohol diversity by hydrogenation of renewable resources, dehydrogenation of alcohols using semiconductor photocatalysis would be a powerful tool serving as electron, carbon, and hydrogen source. In this lecture, photocatalytic N-alkylation with alcohols[1] is briefly introduced. Thereafter, hydrogenation of unactivated amides[2] and carboxylic acids[3] promoted thermally by transition metal catalysts under dark that gives alcohol and amine diversity, will be presented.

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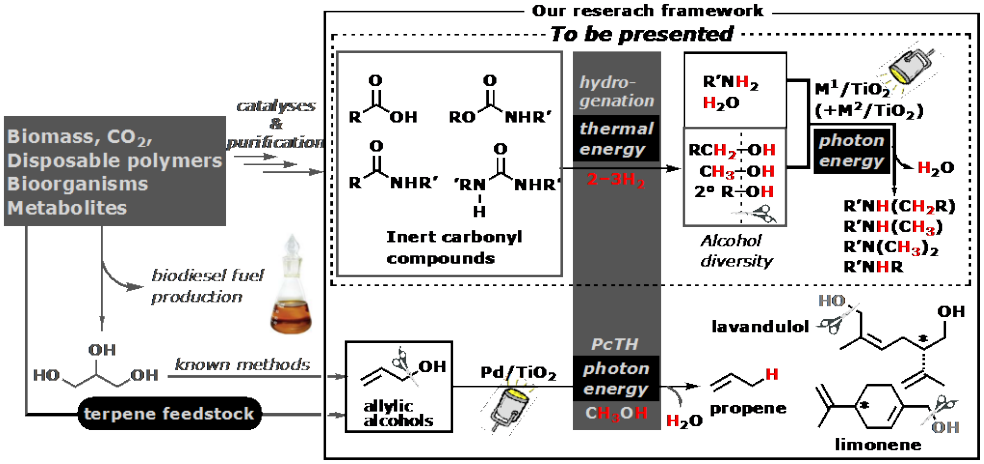

Platform and fine chemicals obtainable through catalytic hydrogen management using thermal and photon energy

[1] L. Wang, Y. Morioka, K. Binder, A. E. H. Wheatley, S. Saito, H. Naka, *Sci. Rep.* **8**:6931 (2018); V. N. Tsarev, Y. Morioka, J. Caner, Q. Wang, R. Ushimaru, A. Kudo, H. Naka, S. Saito, *Org. Lett.* **17**, 2530 (2015). [2] T. Miura, M. Naruto, K. Toda, T. Shimomura, S. Saito, *Sci. Rep.* **7**:1586 (2017). [3] M. Naruto, S. Agrawal, K. Toda, S. Saito, *Sci. Rep.* **7**:3425 (2017); M. Naruto, S. Saito, *Nat. Commun.* **6**:8140 (2015).

Author Biography: Susumu SAITO (Assistant Professor (1995); Doctoral Degree of Engineering (1998); Associate Professor (2002); Full Professor (2015)) is a Professor at Nagoya University. His interest is focusing on the development of new concept and catalytic methodology for organic synthesis using alcohols, carboxylic acid derivatives, CO_2, H_2 and H_2O as key ingredients. Pursuing molecular- and semiconductor photo-catalyses include hydrogenation/dehydrogenation, hydrogenolysis/alcoholysis, hydration/dehydration, dehydrative C–X (X = H, C, O, N) coupling and CO_2 transformation, which could contribute for sustainable and greener materials and pharmaceuticals science.