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Clean and sustainable liquid hydrogen storage materials

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To address the increasing energy and environmental issues, efficient and sustainable energy carriers alternative to carbon based fuels for the current power generation are being extensively investigated. One of the key issues for achieving the "hydrogen economy" is to develop reliable hydrogen storage/release systems that store/release large quantities of hydrogen in a safe and economically viable manner. In this context, liquid organic hydrogen carriers (LOHCs) such as carbazole and methylcyclohexane have attracted significant attention owing to their high reversibility as well as high volumetric hydrogen storage density. In addition to this, carbon dioxide is a potential hydrogen storage medium that can store hydrogen as a form of liquid formic acid (HCO_2H, FA) with a significantly high volumetric H_2 storage capacity of 53 $g.L^{-1}$, much higher than compressed hydrogen gas. Despite the attractive hydrogen release properties of these materials, however, it is still needed to screen highly active and selective catalysts for the reversible hydrogen storage. In this contribution, Pd-based heterogeneous catalysts for FA dehydrogenation are introduced, and relevant H_2-release properties are discussed. Furthermore, liquid organic materials are also proposed as potentially reversible hydrogen energy carriers, and their hydrogenation properties are discussed.

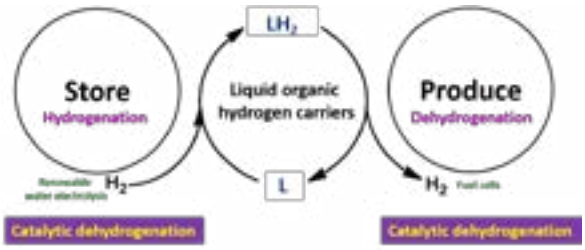

Figure: Catalytic Dehydrogenation

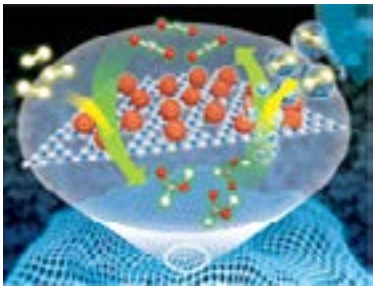

Figure: A schematic image for FA dehydrogenation over Pd/C_3N_4 catalysts]

Biography

Chang Won Yoon is a Principal Research Scientist of the Fuel Cell Research Center at the Korea Institute of Science and Technology (KIST). He is also a Professor of the KHU-KIST Department of Converging Science and Technology at Kyung Hee University as well as a Professor of the KIST School (E&ET). He received his BS and MS in Chemistry at POSTECH in Korea and obtained the Doctoral degree (PhD, 2008) in Chemistry at the University of Pennsylvania (PENN) in USA. He further conducted research associated with Clean Energy in Chemistry at the University of California, Berkeley (2008-2010), and then joined the KIST in 2010. His research has been focusing on hydrogen production and storage particularly for fuel cell technologies as well as on catalysis for a number of chemical transformations related to energy conversion.

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