

Development of hydrogenation and dehydrogenation reactions based on the use of iron complexes bearing group 14 element ligands

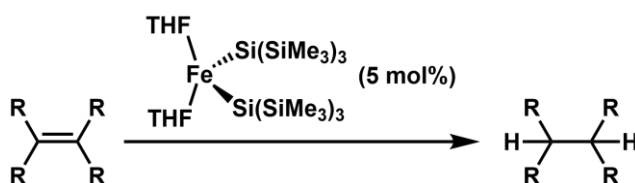
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Hydrogenative and dehydrogenative reactions are one of the most fundamental reactions in modern organic and organometallic chemistry. In the conventional catalysis, precious metal catalysts are generally for these reactions. However, due to the increasing interest in the development of cheap and environmentally benign catalytic reactions, development of base metal catalyst has recently received much attention. In this presentation, we wish to report the development of two types of reactions, namely, hydrogenation of alkenes as well as dehydrogenation of group 14 hydrides, in which iron species bearing group 14 elements ligands acted as a key species.

First, we found that iron(II) disilyl complex $\text{Fe}[\text{Si}(\text{SiMe}_3)_3]_2(\text{THF})_2$ (**1**)¹ showed good catalytic performance toward hydrogenation of various alkenes including sterically hindered ones. In a general catalysis, hydrogenation of alkenes were achieved in toluene at 80 °C in the presence of 5 mol% of **1** (Scheme 1). It should be mentioned that unfunctionalized multi-substituted alkenes such as 2,3-dimethyl-2-butene or limonene were also hydrogenated by this catalytic system.²

Second, dehydrogenative coupling of group 14 hydrides catalyzed by iron complexes was achieved. As the representative, dehydrogenative coupling of Ph_2GeH_2 to afford $\text{Ph}_{10}\text{Ge}_5$ proceeded quantitatively mediated by $\text{Fe}(\text{Mes})_2(\text{I}^t\text{Pr}_2\text{Me}_2)_2$ (Mes = 2,4,6-trimethylbenzene, $\text{I}^t\text{Pr}_2\text{Me}_2$ = 1,3-diisopropyl-4,5-dimethylimidazole-2-ylidene).



Scheme 1. Hydrogenation of unfunctionalized alkenes.

1) Arata, S.; Sunada, Y. *Dalton Trans.* **2019**, 48, 2891-2895.

2) Kobayashi, Y.; Sunada, Y. *ACS Sustain. Chem. Eng.* accepted.

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