

## Molybdenum-Germylyne Complex as a Catalyst for Hydroboration of Carbonyl Compounds

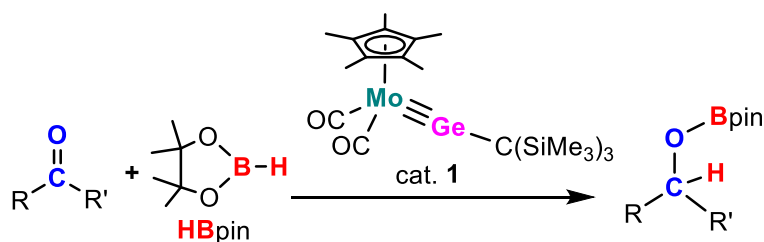
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Carbyne complexes with transition metal-carbon triple bonds are well known to act as catalysts. In contrast, there has been no report on catalytic reactions by analogous complexes with heavier Group 14 elements. These analogous complexes, termed as metal-tetrylyne complexes, are theoretically expected to have unique properties given their highly  $M(\delta^-)\equiv E(\delta^+)$  ( $E = \text{Si, Ge, Sn, Pb}$ ) polarized bonds.<sup>1</sup>

Recently, our group discovered that molybdenum-germylyne complex **1** with a metal-germanium triple bond<sup>2</sup> can catalyze the hydrosilylation of carbonyl compounds.<sup>3</sup> This is the first catalytic system involving metal-germanium multiple bonds as well as the first catalytic reaction for metal-tetrylyne complexes.

In this work, we report that the same molybdenum-germylyne complex **1** can also promote catalytic hydroboration of carbonyl compounds to afford the corresponding products in high NMR yields with modest TOF's upon heating. Theoretical calculations suggest that the mechanism for the catalytic hydroboration features a new mode of metal-ligand cooperativity.



1) a) H. Hashimoto, K. Nagata, *Chem. Lett.* **2021**, 50, 778-787. b) H. Hashimoto, H. Tobita, *Coord. Chem. Rev.* **2018**, 355, 362-379.

2) T. P. Dhungana, H. Hashimoto, M. Ray, H. Tobita, *Organometallics* **2020**, 39, 4350.

3) a) T. P. Dhungana, Ph.D. Dissertation, Tohoku University 2019. b) T. P. Dhungana, N. Takagi, B. Zhu, K. Nagata, S. Sakaki, H. Tobita, H. Hashimoto, *Manuscript to be submitted*.