

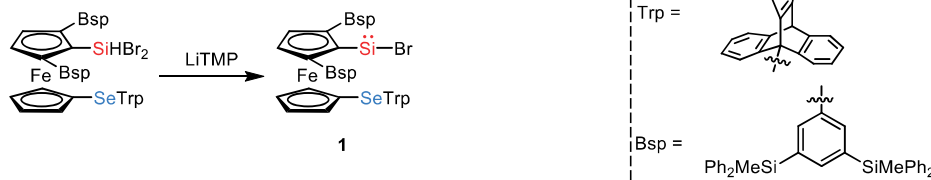
高効率な Sn/Pb 混合ペロブスカイト太陽電池の開発 Development of Efficient Mixed Sn and Pb-based Perovskite Photovoltaics

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Summary of research results

The goal of our collaborative research with Prof. Dr. Atsushi Wakamiya (ICR, Kyoto University) is development of efficient Pb/Sn-based perovskite-based solar cells, and pioneering research achievements on the basis of the fusion of elemental science and functional physical chemistry. Challenges for efficient perovskite-based solar cells such as Sn(II)/Pb(II)-based ones include the facile oxidation of divalent E(II) which leads to the increased nonradiative charge recombination in the perovskite films. Thus, we focused our research targets on the creation of low-coordinated main group element species as effective oxidation scavengers, which exhibit redox-activity and considerable solubility in organic solvents.

Silylenes ($R_2Si:$) are attractive intrinsically extremely reactive species, which would exhibit possible ability of working as effecting oxidation scavengers. Isolable silylenes remain scarce, and in most hitherto reported examples, the silylene center is stabilized by electron-donating substituents (e.g., heteroatoms such as nitrogen), which results in electronic perturbation. We have been interested in the chemistry of redox-active silylenes with carbon-based substituents such as ferrocenyl groups. Here, we have designed the isolable ferrocenylsilylene with intramolecular Se-coordination moiety. As a result, ferrocenylbromosilylene **1** has been successfully generated in situ, which could be intermolecularly trapped by 2,3-dimethyl-1,3-butadiene. It should be expected to work as an useful building block for an appropriate silylene, because the possible substitution at the Si-Br moiety could afford several types of silylenes. We are grateful to Prof. Wakamiya (ICR, Kyoto Univ.) for the support on the research, and fruitful discussions.



Presented papers (with acknowledgments)

- (1) A. Nomoto, K. Sugamata, T. Sasamori, "Bis(methylene)- λ 5-phosphane anions", *Chem. Sci.*, 15, 20509-20514 (2024).
- (2) K. Iijima, K. Sugamata, P. K. Majhi, T. Sasamori, "Bis(ferrocenyl)stannylene", *Eur. J. Inorg. Chem.*, 27, e202400198 (2024).