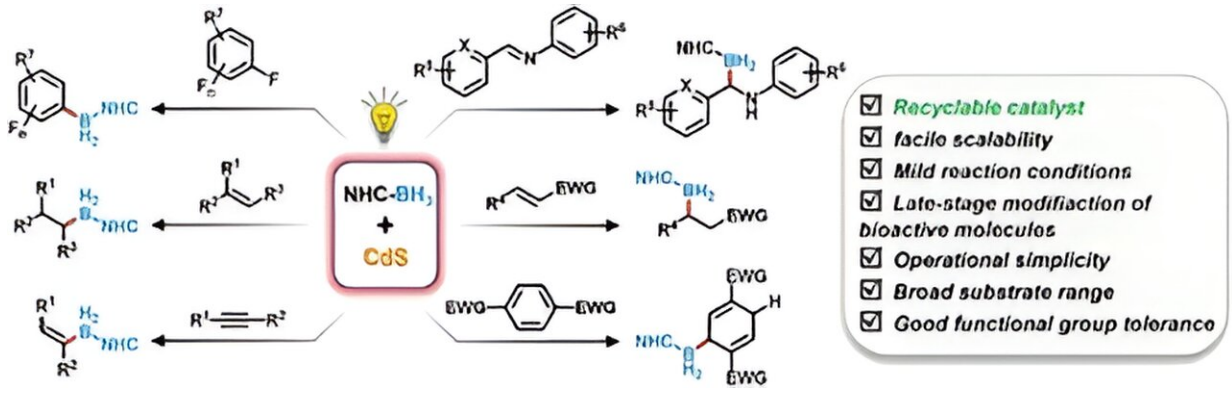
Semiconductor photocatalyst helps to realize borylation reaction

August 30 2023, by Li Yuan



Credit: *Angewandte Chemie International Edition* (2023). DOI: 10.1002/anie.202306846

A research group led by Prof. Dai Wen from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has realized borylation reactions involving N-heterocyclic carbene boranes (NHC-BH_3) with a simple and efficient heterogeneous photocatalytic system, enabling synthesis of high-value transformations including hydroboration and boron substitution products. Their study was published in *Angewandte Chemie International Edition* on Aug. 9.

NHC-BH_3 are novel boron sources in free radical borylation reactions due to their stable chemical properties and straightforward preparation

method. However, the application of NHC-BH^3 is hindered by the requirement of a large quantity of harmful free radical initiators, as well as the expensive and non-recyclable homogeneous photocatalysts.

For this study, the researchers used cadmium sulfide nanosheets, which were easily prepared, as heterogeneous photocatalysts. And they served NHC-BH_3 as a boron source, enabling the selective borylation reaction of various alkenes, alkynes, imines, aromatic (hetero) rings, and bioactive molecules under room temperature and light conditions. Since the conversion process fully utilized photogenerated electron-hole pairs, the need for sacrificial agents was eliminated.

Furthermore, they found that the photocatalytic system could not only achieve gram-scale scale-up, but also maintain a stable yield after multiple cycles of the catalyst. It could also serve as a recyclable general platform, allowing the recovered catalyst to continue catalyzing different kinds of substrates.

"Our study provide new ideas for the development of free radical borylation reactions using NHC-BH_3 as a boron source, and the organoboranes obtained from the reaction may be used to synthesize synthetic building blocks that contain hydroxyl, borate, and difluoroborane reactive sites," said Prof. Dai.

More information: Fukai Xie et al, Facile Borylation of Alkenes, Alkynes, Imines, Arenes and Heteroarenes with N-Heterocyclic Carbene-Boranes and a Heterogeneous Semiconductor Photocatalyst, *Angewandte Chemie International Edition* (2023). DOI: 10.1002/anie.202306846

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