Basic Research

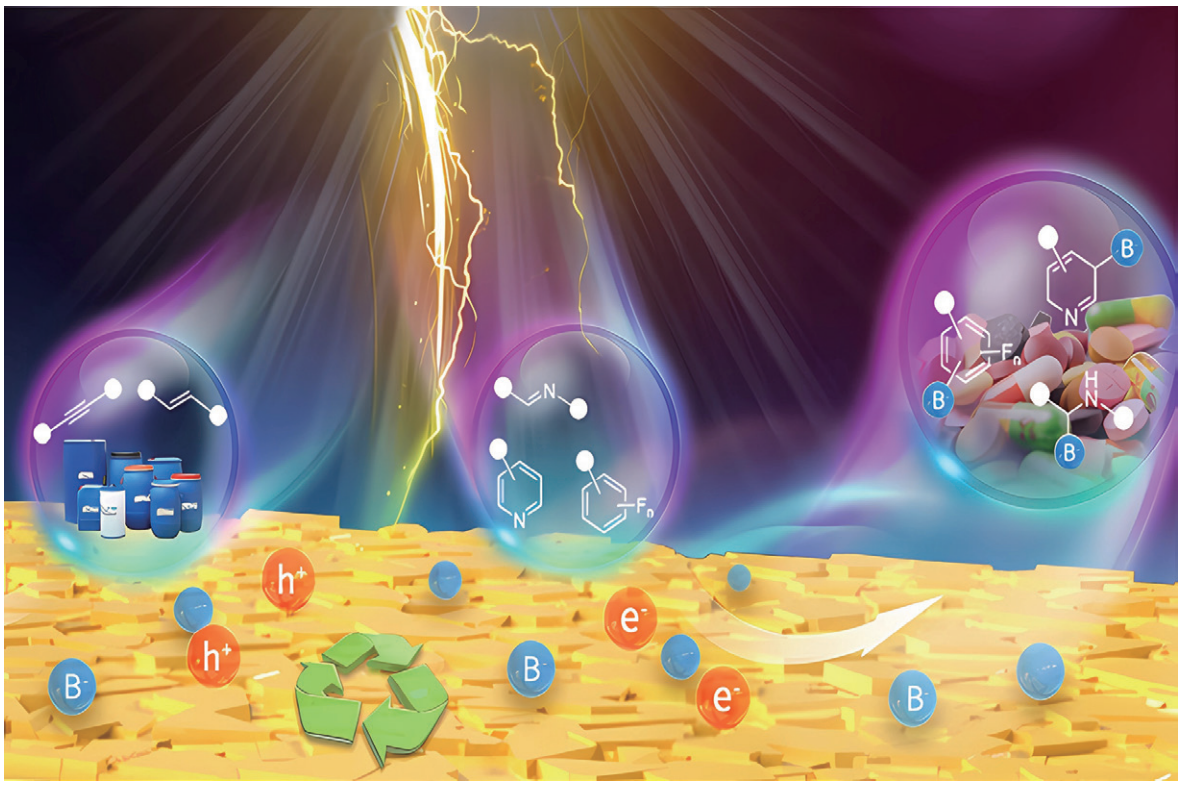
Semiconductor Photocatalyst Enables Borylation Reaction

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) using a simple and efficient heterogeneous photocatalytic system. This enables the synthesis of high-value transformations, including hydroboration and boron substitution products.

The study was published in *Angewandte Chemie International Edition* on August 9 and was selected as a Hot Paper.

NHC-BH_3 are novel boron sources for free radical borylation reactions due to their stable chemical properties and straightforward preparation method. However, their application is hindered by the requirement of large quantities of harmful free radical initiators, as well as expensive and non-recyclable homogeneous photocatalysts.

In this study, the researchers utilized cadmium sulfide nanosheets, which were easily prepared, as heterogeneous photocatalysts. These photocatalysts 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-



Cadmium sulfide nanosheets serving as heterogeneous photocatalysts for borylation reactions with NHC-BH3. The photocatalysts enable the selective borylation of various alkenes, alkynes, imines, aromatic (hetero)rings, and bioactive molecules under mild conditions. (Image by DICP)

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 provides 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 containing hydroxyl, borate, and difluoroborane reactive sites," said Prof. DAI.

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Reference

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