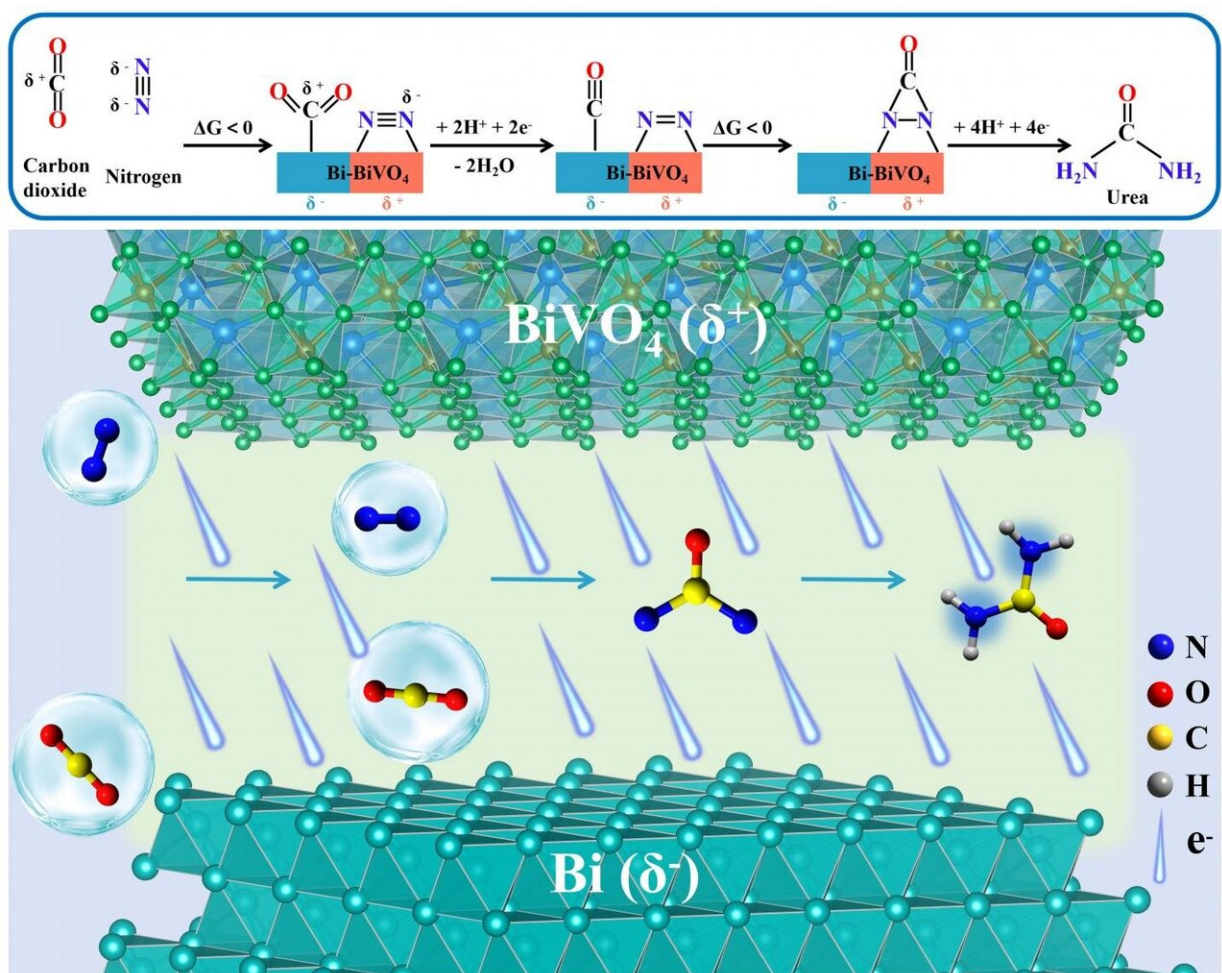


Novel catalysts improve efficiency of urea synthesis at ambient conditions

February 26 2021



The schematic electrocatalytic urea synthesis mechanism based on Bi-BiVO₄ Mott-Schottky heterostructure synergistic effects Credit: Zhang Guangjin and Yuan Menglei

Converting both nitrogen (N_2) and carbon dioxide (CO_2) into value-added urea molecules via C-N coupling reaction is a promising method to solve the problem of excessive CO_2 emissions.

Compared with huge energy consumption [industrial processes](#), electrochemical urea synthesis provides an appealing route under mild conditions. However, it still faces challenges of low catalytic activity and selectivity.

A research team led by Prof. Zhang Guangjin from the Institute of Process Engineering (IPE) of the Chinese Academy of Sciences fabricated Bi-BiVO₄ Mott-Schottky heterostructure catalysts for efficient urea synthesis at ambient conditions.

This work was published in *Angewandte Chemie International Edition* on Feb. 25.

The spontaneous charge transfer at the heterointerfaces promotes the formation of space-charge region. "The space-charge region not only facilitates the targeted adsorption and activation of CO_2 and N_2 molecules on the generated electrophilic/nucleophilic regions, but also effectively suppresses CO poisoning and the formation of endothermic *NNH intermediate," said Prof. Zhang.

The adsorbed * N_2 can promote CO_2 reduction to form CO, and then the generated CO will further react with * N_2 to produce the desirable *NCON* intermediate via electrochemical C-N coupling reaction.

"The subsequent protonation process preferentially undergoes the alternating mechanism until the formation of urea," said Prof. Zhang.

The researchers used linear sweep voltammetry (LSV) to preliminarily evaluate the potential performance of urea electrosynthesis with Bi-

BiVO₄ hybrids. The results showed that Bi-BiVO₄ hybrids exhibited good performance in electrocatalytic nitrogen reduction reaction (NRR) and CO₂ reduction reaction (CO₂RR), which ensured the electrocatalytic production of [urea](#).

More information: Menglei Yuan et al, Unveiling Electrochemical Urea Synthesis by Co-Activation of CO₂ and N₂ with Mott-Schottky Heterostructure Catalysts, *Angewandte Chemie International Edition* (2021). [DOI: 10.1002/anie.202101275](https://doi.org/10.1002/anie.202101275)

Provided by Chinese Academy of Sciences

Citation: Novel catalysts improve efficiency of urea synthesis at ambient conditions (2021, February 26) retrieved 26 April 2024 from <https://phys.org/news/2021-02-catalysts-efficiency-urea-synthesis-ambient.html>

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