



2022「中技社科技獎學金」

2022 CTCI Foundation Science and Technology Scholarship

境外生研究獎學金

Research Scholarship for International Graduate Students



Metal-free four-in-one modification of g-C₃N₄ for superior photocatalytic CO₂ reduction and H₂ evolution

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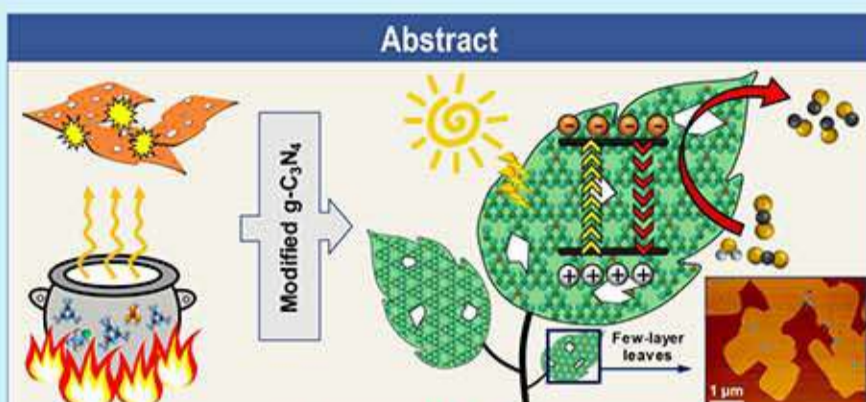
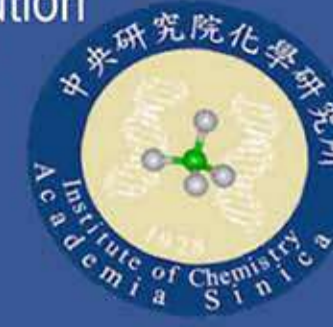
^cSustainable Chemical Science and Technology, Taiwan International Graduate Program, Academia Sinica, Taiwan

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^eCenter for Condensed Matter Sciences, National Taiwan University, Taiwan

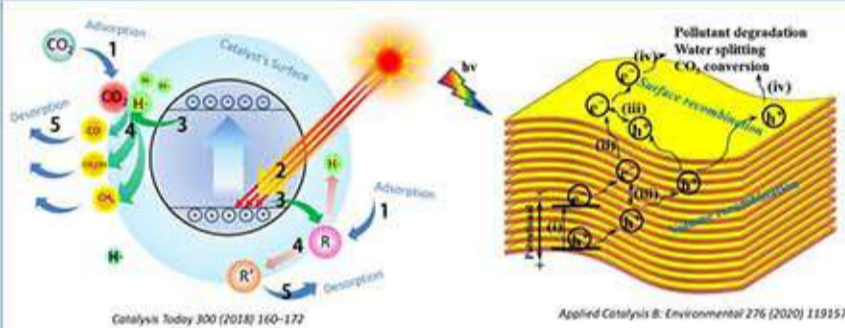
^fCenter of Atomic Initiative for New Materials, National Taiwan University, Taiwan

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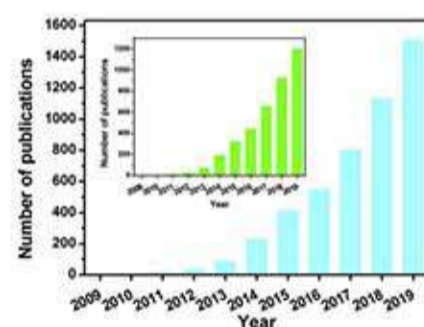
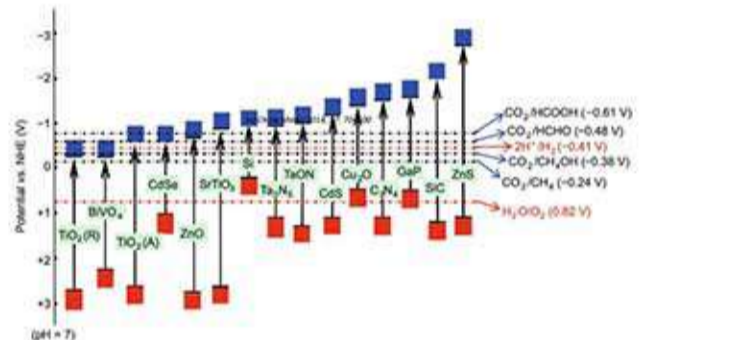
A simple and environmentally benign one-pot thermal process has been employed to synthesize a novel amine-functionalized ultrathin nanoporous boron-doped g-C₃N₄. The modified g-C₃N₄ acts as a porous low-dimensional artificial leaf with excellent photocatalytic activity toward CO₂ reduction and H₂ generation

Principles & Motivation



Catalysis Today 300 (2018) 160-172

Applied Catalysis B: Environmental 276 (2020) 119157



Research Plan

Insufficient visible light utilization

g-C₃N₄ drawbacks

High recombination rate

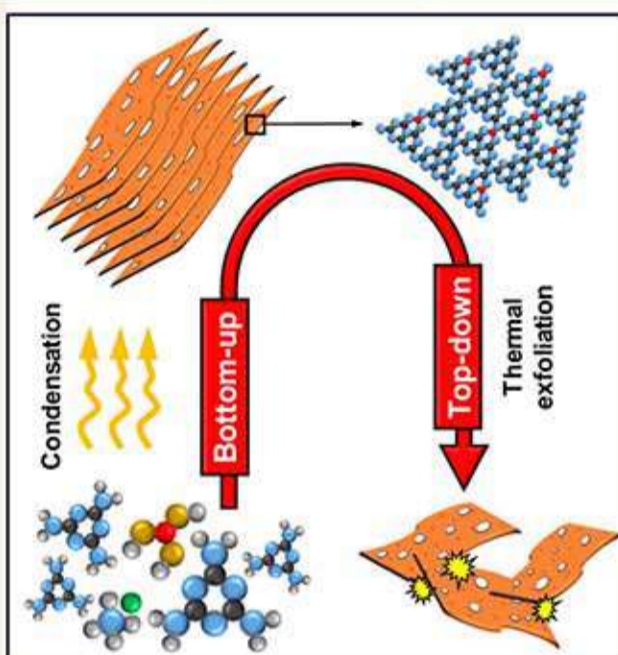
Low specific surface area

Challenge?
To find a green and industrial-scale applicable route that can simultaneously solve g-C₃N₄ drawbacks

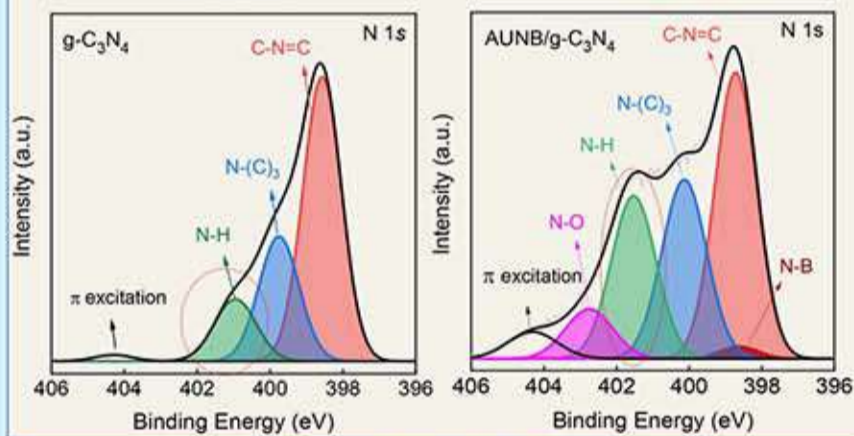
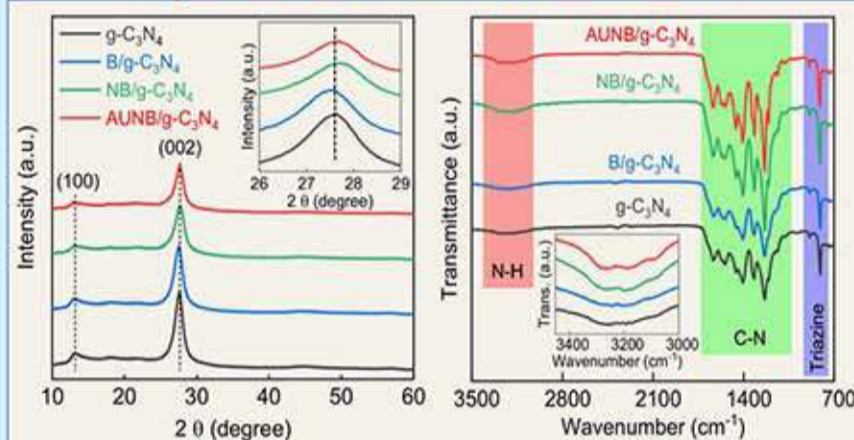
Gap?
Utilization of g-C₃N₄ as a single material active photocatalyst without combination with other semiconductor

IDEA Metal-free four-in-one combinative modification

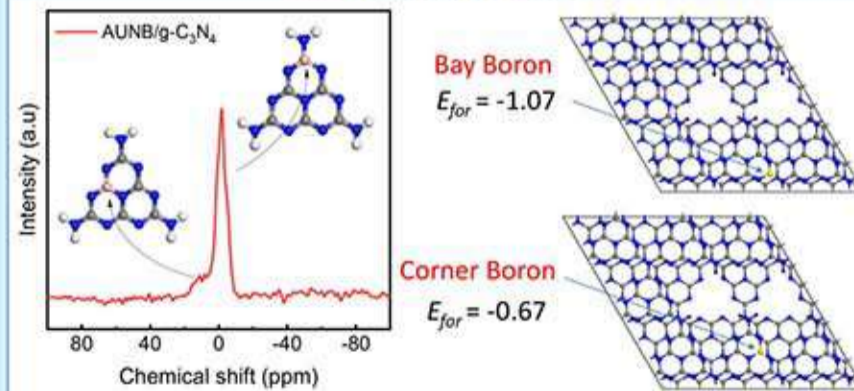
Experimental Design



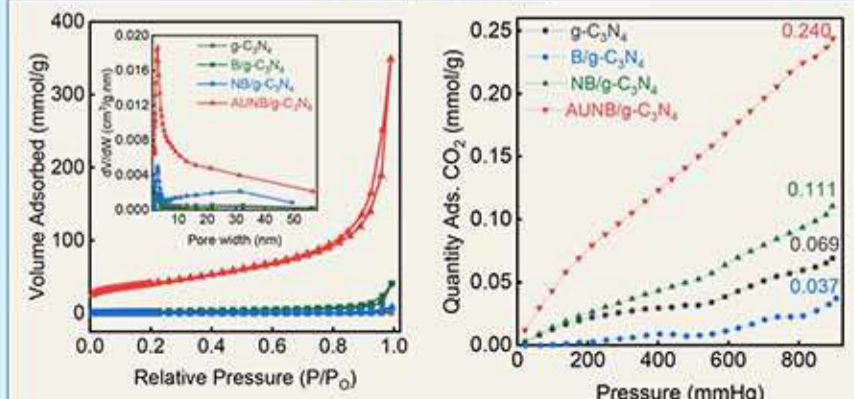
Crystal Structure & Amine Functionalization



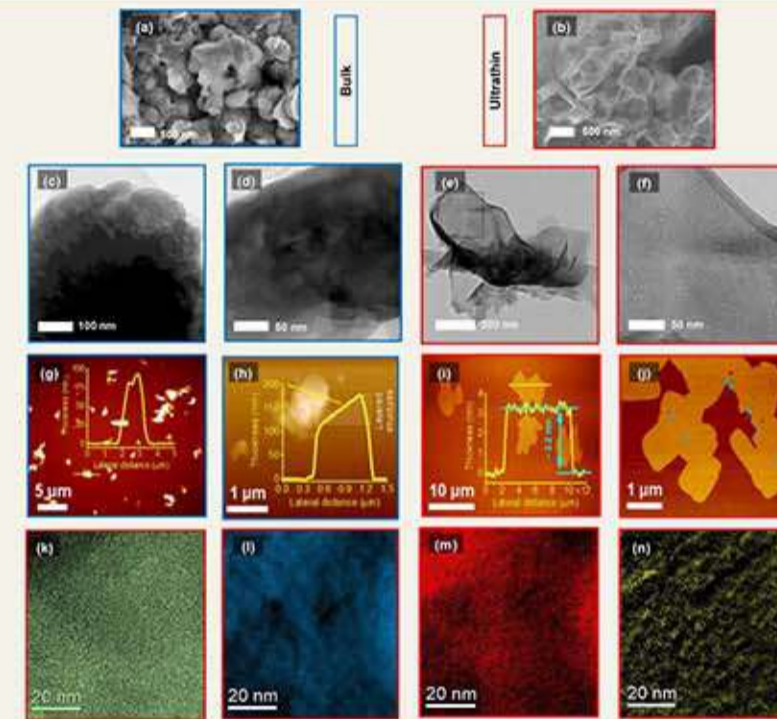
Boron Doping Position



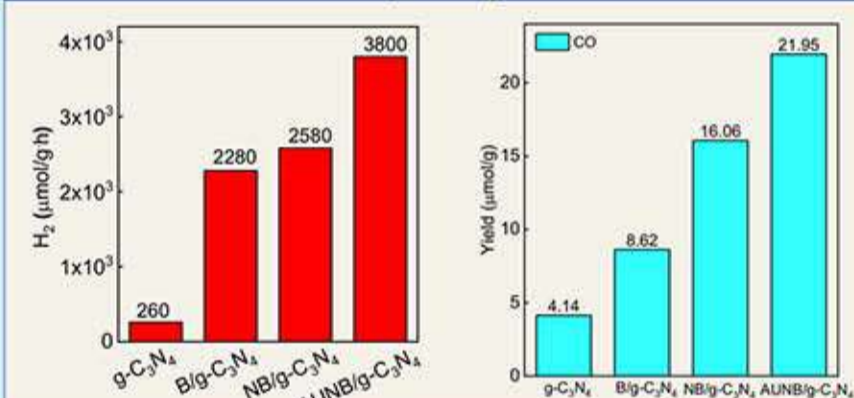
Adsorption Study



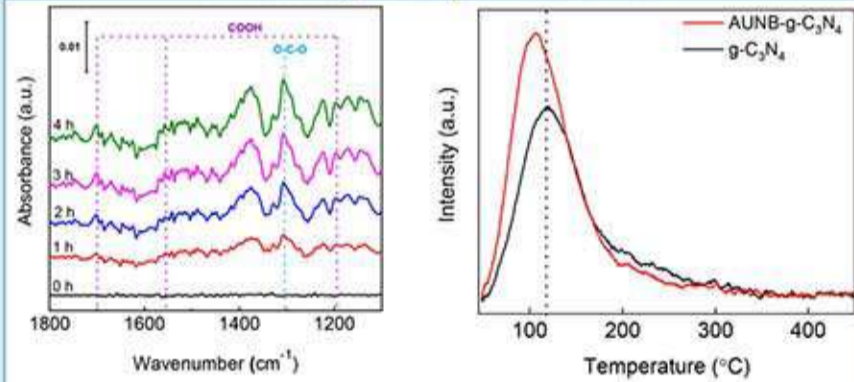
Morphological Properties



Photocatalytic CO₂RR & HER



Photocatalytic CO₂RR Mechanism



Research Outcome

- M. Kamal Hussien et al. "Metal-free four-in-one modification of g-C₃N₄ for superior photocatalytic CO₂ reduction and H₂ evolution.", Chemical Engineering Journal 430 (2022) 132853
- Active Sites Modulation and Boosting the Exciton Dissociation of Exfoliated Boron-Doped g-C₃N₄ Towards Highly Efficient Solar to Fuel Conversion, Under submission

Acknowledgement



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