Synthesis of High Surface Area VS₂ for Nitrogen Reduction
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Introduction

Transition Metal Dichalcogenides (TMDCs)
- Earth abundant
- High surface area 2D materials
- Tunable electrocatalysts

TMDC structure (S in yellow, M in green)

VS₂
- Metallic TMDC
- V edge-site predicted to be selective towards nitrogen reduction versus hydrogen evolution¹,²

Electrochemical Nitrogen Reduction Reaction (NRR)
- Fossil-fuel free
- Generates NH₃ essential to agriculture

Future Work

Synthesis of High Surface Area VS₂ for Nitrogen Reduction
Hydrothermal Growth of Edge-Site Rich VS₂

VS₂/CP (hydrothermal)

Na₃VO₃
C₂H₅NS
160 °C
H₂O
20 h

NH₄VO₃
C₂H₅NS
160 °C
octylamine
20 h

VS₂/CP (solvothermal)

VS₂/CP SEM image

CP SEM image

VS₂/CP SEM image

VS₂/CP Electrochemical Generation of S Vacancies

Theory: S vacancy sites increase NRR activity

Material | NRR Activity?
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Exfoliated TiS₂ | Negligible activity
Hydrothermal VS₂/CP | Negligible activity
Solvothermal VS₂/CP | Negligible activity
Electrochemical S vacancy (-0.9 V) VS₂/CP | Negligible activity

NRR Testing

Reduce N₂ to NH₃ in H-cell

ex-situ quantification of NH₃