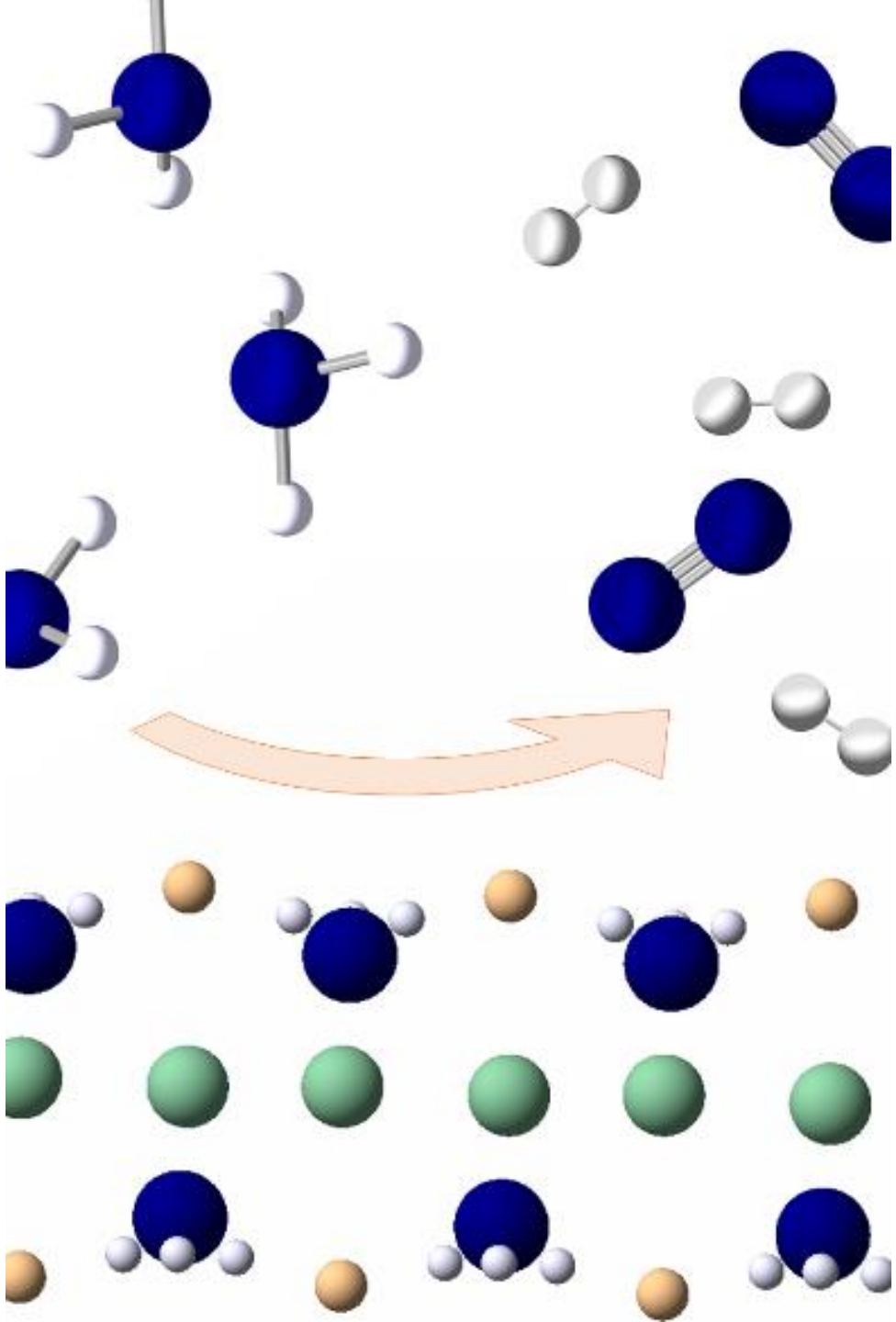


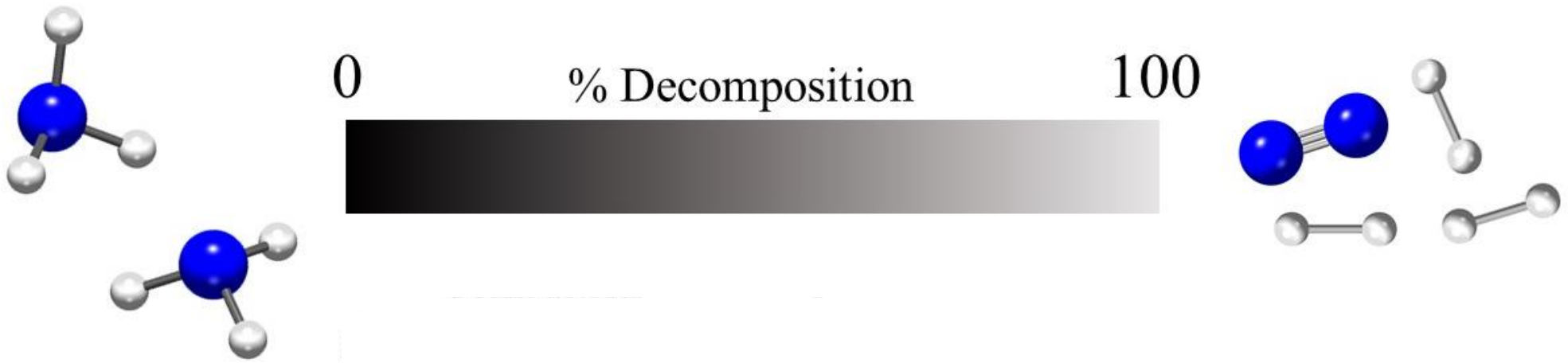
UNIVERSITY OF BIRMINGHAM

Ammonia cracking: ready to go?

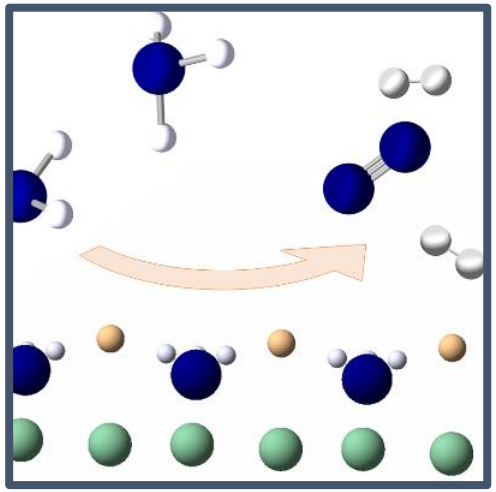
Dr Josh Makepeace
UKRI Future Leaders Fellow, Lecturer in Materials Chemistry

Ammonia for H_2@Scale,
May 2021

Ammonia cracking: unlocking flexible electricity generation



Ammonia cracking technology:



Heterogeneous catalysis

Provision of reducing atmosphere for metallurgy

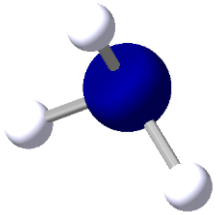
1–1500kg H_2/day

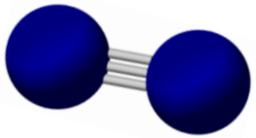
Operating temperature: 850–1000°C

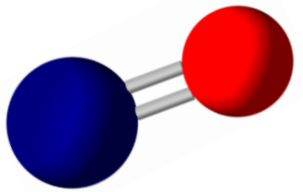
Electrical efficiency ~ 30–60%

Low pressure hydrogen

Gas purification:

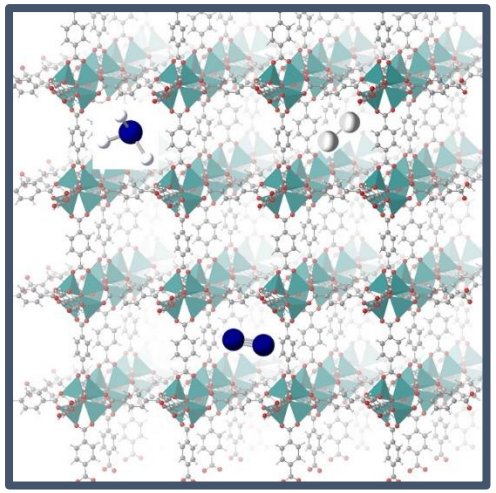




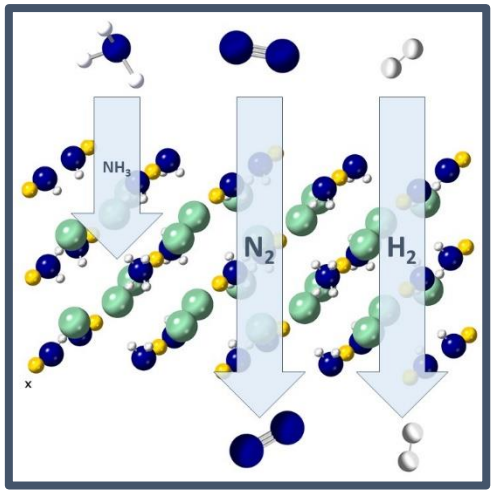


Ammonia	Nitrogen	NOx
• Function, safety and environment • <0.1ppm in PEMFC	• H_2 diluent • <300ppm in PEMFC	• Emissions control in combustion

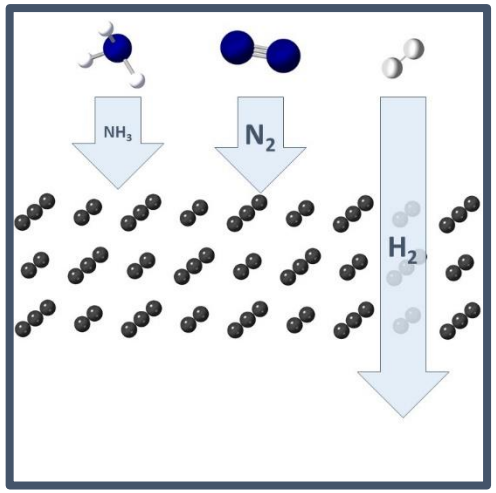
Gas purification technology:



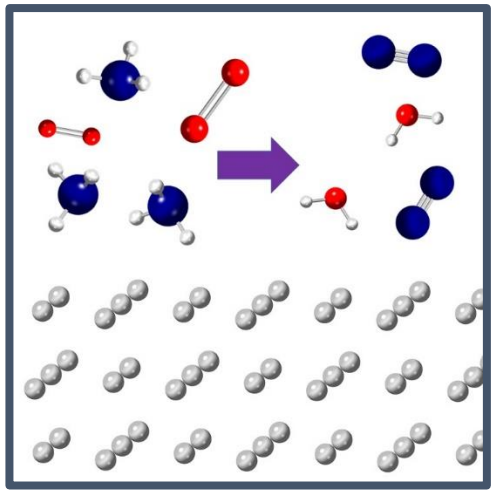
Pressure-swing adsorption



Sorbents



Membranes



Catalytic oxidation

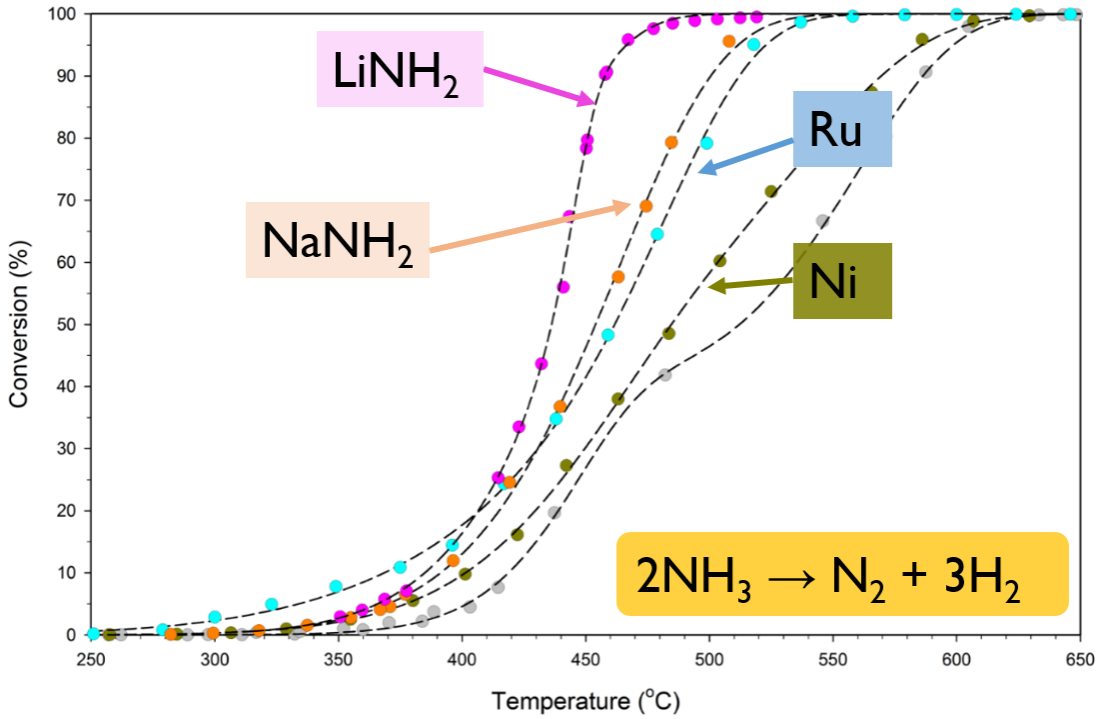
Future directions and key questions

Catalysts

- Significant ongoing catalyst optimisation research (catalysts, supports, promoters)
- How does the application dictate the requirements of the catalyst?
- Catalyst and reactor/system design for maximising conversion, heat transfer and efficiency

Purification

- Where is the balance between purity and cost for each application?
- Cheap and robust ammonia scrubbing systems
- Cheap and reliable sub-ppm NH_3 detection



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What is the cost?
per kg H_2 / kWh

Ammonia cracking and purification: Technical Briefing

AMMONIA ENERGY ASSOCIATION

Aim: To provide a key resource for techno-economic details of ammonia cracking and hydrogen purification technologies

- Outlining the potential for ammonia cracking to contribute to sustainable energy goals
- Summarising key concepts and technology
- Identifying key areas needing further development
- Research areas → early-stage technology → near-commercial → commercial
- Highlighting demonstration projects

What would you like to see in the report?

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