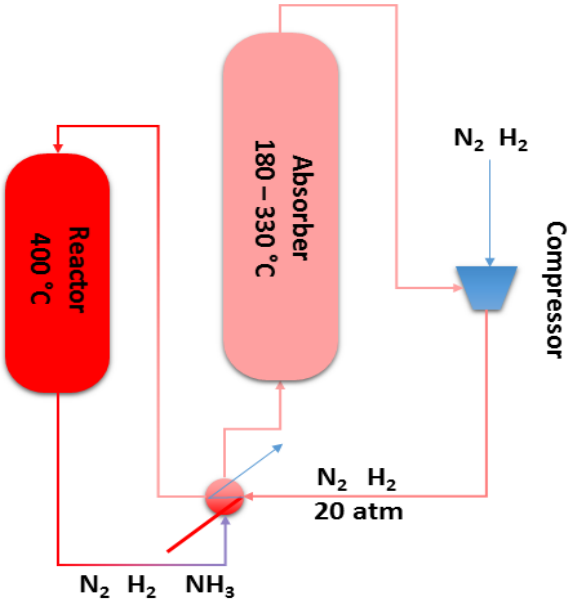
REFUEL Project: Small Scale Ammonia Synthesis Using Stranded Wind Energy 1562-1584

Project Summary: The University of Minnesota is leading a partnership with DOE's National Renewable Energy Laboratory (NREL) and Proton On Site to develop a small-scale ammonia synthesis system using water and air, powered by wind energy. Instead of developing a new catalyst, this team aims to increase process efficiency by absorbing ammonia at modest pressures as soon as it is formed. A technoeconomic model of the process will also be developed to aid commercialization of this exciting technology.

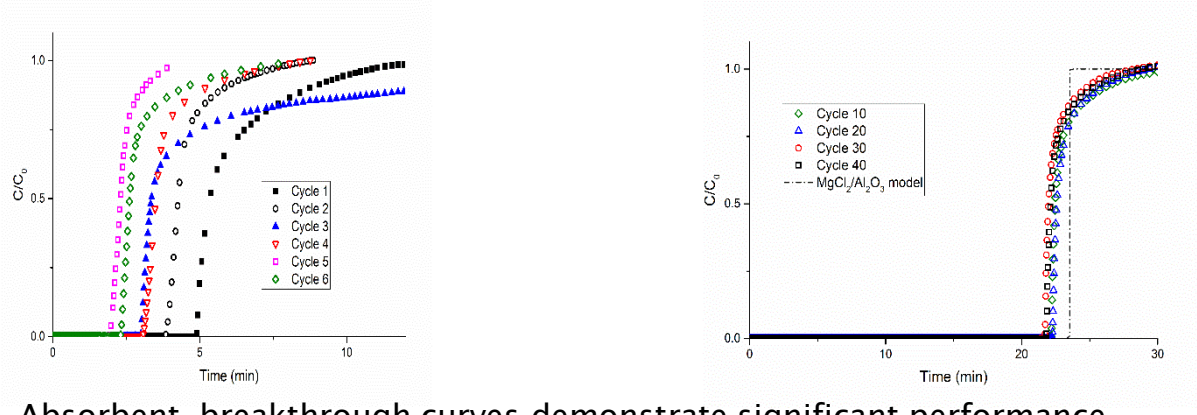
Reaction-Absorption



Project Metrics

Metric	Driver	Potential Cost Impact
Operating pressure	Reduced from 200 bar to 20 atm	+
Energy demand	Reduced compressor power demand	++
Operating Cost	Lower capital and utility costs	+
Process sustainability	Reduced energy demand and improved energy integration	++
Ammonia production cost	Separation technology that improve overall costs.	+

Project Progress – Improvements in Ammonia Absorber Efficiency



Absorbent breakthrough curves demonstrate significant performance improvements already achieved early in the project.

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Key Features and Benefits

- 10 X reduction in reaction pressure from 200 atm to 20 atm or less
- Lower capital costs
- Lower operating costs
- Enables:
  - Efficiency improvements for existing Haber Bosch plants
  - Economically efficient decentralized ammonia production
  - Storage of energy as ammonia
- Patent pending new product – Ammonia Absorbent Media
- Patent pending Low Pressure Ammonia Synthesis Process

Commercialization Potential

Products

- Novel Process Equipment – Absorbent Bed
- Novel Consumable Product – Engineered Absorbent Particles

Markets

- Replace condenser in existing Haber-Bosch plants
- Create smaller scale plants powered by stranded energy to enable:
  - Local production of anhydrous ammonia fertilizer
  - Local production of anhydrous ammonia fuel

Project Team Roles

Absorbent improvement of current approach at UMN Wind to Ammonia Pilot Plant

University of Minnesota
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H_2

N_2

e^-

Water electrolysis Air PSA

Ammonia Synthesis

NH_3

TEA and T2M partners

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For More Information See: *Small Scale Ammonia Synthesis Using Stranded Wind Energy* @ URL: *https://wcroc.cfans.umn.edu/research-programs/renewable-energy/ammonia*