

MICROCHANNEL REACTOR FOR EFFICIENT HYDROGEN PRODUCTION FROM AMMONIA

Generates hydrogen efficiently from ammonia in a compact, carbon-free system using integrated heat from the same reactor.

Problem / Market Need

Hydrogen is a key energy carrier for a low-carbon future, but transporting it at scale is challenging due to its low density and storage requirements. Liquid hydrogen carriers, such as ammonia, are emerging as practical solutions for moving large quantities of hydrogen across long distances. There is growing demand for technologies that can efficiently release hydrogen from ammonia while maintaining a carbon-free, high-density, and scalable process suitable for industrial and energy applications.

Description of Solution / Technology

This technology uses a microchannel reactor with two integrated chambers. Ammonia is first combusted in one chamber, generating heat, which is transferred through the reactor wall to a second chamber where a separate stream of ammonia undergoes decomposition to produce hydrogen. By using the heat generated within the reactor, the system efficiently releases hydrogen without additional energy input. Its compact design makes it suitable for large-scale hydrogen production and transport applications, particularly for ammonia-based liquid hydrogen carriers.

Key Benefits / Advantages

- Enables large-scale hydrogen release from ammonia for transport and energy use.
- Supports a carbon-free value chain from ammonia production to hydrogen generation.
- Uses internally generated thermal energy, improving efficiency and reducing external energy needs.

Applications / Relevant Industries

This technology's energy efficient design and scalability enables applications across multiple sectors, including:

- Energy Generation & Storage: Large-scale hydrogen for grid balancing and energy storage.
- Industrial & Chemical Processing: Hydrogen supply for refineries, fertilizer, and chemical production.
- Clean Fuels & Hydrogen Economy: Hydrogen for fuel cells, transport fuels, and power-to-gas systems.

Stage of Development

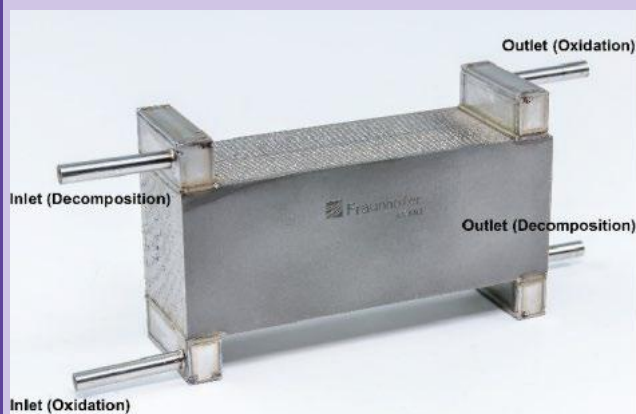
Demonstrated at laboratory scale, the technology is ready for pilot testing and integration into large-scale ammonia-to-hydrogen systems.

Intellectual Property Status

Protected by South African Patent ZA 2017008363 B (priority 28 Mar 2017; granted 12 Sep 2019), securing exclusive rights to this energy-efficient hydrogen production method.

Opportunity

The technology is available for licensing, co-development, or integration with ammonia-based hydrogen production and transport systems. Potential partners include energy utilities, hydrogen transport companies, chemical producers, and industrial hydrogen users seeking energy-efficient, carbon-free hydrogen generation. Collaboration could support pilot testing, scale-up, and integration into industrial hydrogen systems.



For enquiries contact:

Technology Transfer and Innovation Support (TTIS)

Dr Mesuli Mbanjwa

Senior Manager: Commercialisation

Email: mesuli.mbanjwa@nwu.ac.za; techtransfer@nwu.ac.za;

Tel: +27 18 299 4902

Image Credits: NWU, Microsoft Stock Images (via Microsoft 365)

Revision date: 10 March 2026

Reference Number: T2016-0071