

A TURBOMACHINE APPLIANCE FOR CLEAN HYDROGEN PRODUCTION

Supersonic turbomachine solar reactor actively sweeps carbon deposits to enable continuous, clog-free methane pyrolysis for clean hydrogen and carbon production.

Methane pyrolysis via solar thermal processing, often referred to as a solar thermal methane pyrolysis process, yields hydrogen and carbon with 8% upgraded higher heating values due to the added solar energy entry into a pyrolysis reactor (a reaction chamber commonly called a solar reactor or solar thermal reactor). A challenge of the methane pyrolysis process is the formation of carbon deposits because of the pyrolysis process, regardless of the source of the thermal heating method. The buildup of carbon deposit adversely affects process continuation due to reactor clogging, increasing maintenance and operational costs. Therefore, it would be desirable to have a way to reduce the deposition and buildup of carbon in pyrolysis reactors.

Purdue inventors have developed a solar reactor integrated with a supersonic axial turbomachine to produce clean hydrogen through methane pyrolysis while minimizing carbon deposition and increasing product yield. Existing systems lack an active method to prevent clogging in the reactor due to solid particle deposition. This leads to periodic shutdowns to clean the reactor and remove carbon deposits. This novel technology overcomes this drawback by using a supersonic turbomachine that continuously sweeps the carbon deposits and pushes them downstream to a collector unit, thus preventing any interruptions for carbon removal.

Advantages:

- Reduction in the deposition and buildup of carbon in the system after its dissociation from methane or other hydrocarbons.
- Actively minimizing solid particle deposition, which is not available in current existing solar reactors.

Technology ID
2023-PANI-70029

Category

Aerospace & National
Security/Hypersonics &
Propulsion Systems
Energy & Power
Systems/Hydrogen & Fuel Cell
Systems
Energy & Power Systems/Power
Generation

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Applications:

- Hydrogen production
- High value carbon production

TRL: 3**Intellectual Property:**

Provisional-Patent, 2022-11-02, United States

Utility Patent, 2023-11-01, United States

Keywords: clean fuel, Green Technology, High value carbon, Hydrogen