TECHBRIEF

PRODUCING CARBON AND HYDROGEN WITH NETL'S NOVEL IRON-BASED CATALYST

OPPORTUNITY:

This new Iron-based catalyst will enable a one-step process to produce hydrogen - a promising energy source that is also environmentally benign - by directly converting methane. The catalyst will eliminate the need to first create syngas and then remove carbon dioxide. In addition to creating hydrogen, carbon, which is also a useful commodity is created as a by-product. This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

The traditional commercial methods of forming hydrogen from methane are based on steam methane reforming, coal or biomass gasification, electrolysis, and thermo-chemical processes. Some of these methods are cost-effective, but each requires that syngas first be created and the water gas shift reaction be used to convert syngas to hydrogen and carbon dioxide. From there, the hydrogen must be purified using pressure swing adsorption to separate the hydrogen for the carbon dioxide. Developing a method that avoids these intermediate steps would reduce the cost of producing valuable hydrogen.

OVERVIEW:

Researchers at NETL have developed a method that avoids the intermediate steps that are normally required when syngas is first formed through traditional hydrogen production methods. The novel iron-based catalyst directly produces hydrogen from methane using a new thermal decomposition of methane (TDM) method. Elemental carbon is also formed during the process, which has immense value in industry.

Conventional TDM methods often employ environmentally-hazardous catalysts such as nickel. Other catalysts containing supported iron and mixed metal oxides such as iron-copper have been used. However, these catalysts failed to produce long term stability and necessary physical strength during long term tests.

This NETL catalyst technology offers multiple advantages over conventional technologies for the production of hydrogen and carbon.

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ADVANTAGES:

- Environmentally safe and low-cost
- Exhibits high strength for long-term reaction stability
- Does not undergo physical and chemical degradation
- Catalyst provided full conversion of methane to hydrogen and carbon at 700-750 C
- Catalyst can be prepared using low cost materials and a low-cost preparation method

APPLICATIONS:

Hydrogen is used in oil refineries, to make ammonia, for methanol production, and in fuel cells. Hydrogen is also the precursor for many everyday products. Elemental carbon has applications in numerous industries including automotive, aerospace, electronics, construction, and defense.

PATENT STATUS:

U.S. Patent Pending (non-provisional patent application)

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Title: Novel Iron Based Catalyst for Production of Carbon and Hydrogen from Decomposition of Methane

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