CATALYTIC NANOCHANNEL REACTOR

TECHNOLOGY PROFILE

OVERVIEW

Energy-efficient hydrogen generation and purification is needed for many clean energy applications and industrial processes. Synkera Technologies Inc. is developing lightweight compact catalytic reactors for fuel reforming and other applications. Targeted reactions occur within high surface area uniform catalytic nanochannels, facilitating efficient and complete reaction. Significant performance and user benefits are expected in comparison over conventional packed bed or wash-coated reactors.

FEATURES

- Mechanically robust and thermally reliable nanoporous catalytic support with surface area up to 100 m^2/g.
- Catalyst distributed within high density (10^8-$10^{12}/cm^2$) arrays of nanopores with controllable diameter (10-300 nm), porosity and aspect ratio.
- Possibility to couple combustion and reforming reactions for net zero heat effect by varying catalyst along the pore.
- Compatible with Synkera hydrogen separation membranes, amenable to membrane-rector architecture.
- Planar catalytic inserts of flexible size (up to 11"x18") and format, either flow-through or flow-by configurations
- Al rim enabling reliable compression sealing.

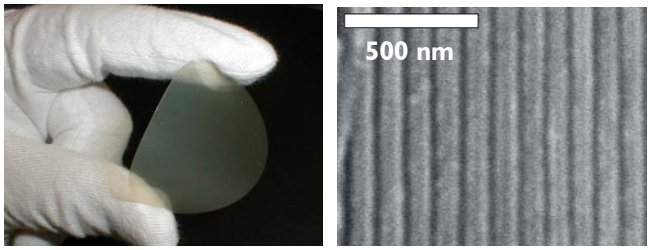
POTENTIAL BENEFITS

- Eliminated external and internal diffusion limitations.
- High space velocity and high conversion efficiency.
- No possibility of channeling or "blow-by".
- Uniform temperature distribution, low thermal mass, rapid start-up and transient response.
- Unique reaction modes and reaction coupling.
- Compact size, low weight/volume, enhanced reliability.
- Easy integration into compact fuel processors. Scalable and manufacturable, enabling economics.

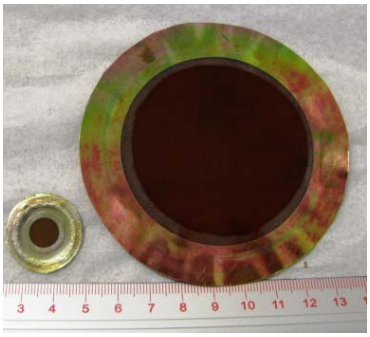
CURRENT STATUS

Synkera is developing and testing operational prototypes of these reactors under government funding. We are focused on conventional and autothermal steam reforming of hydrocarbons and alcohols, water-gas shift reaction and as well as catalytic combustion. Other compact reaction systems could be also enhanced with this patent-pending technology.

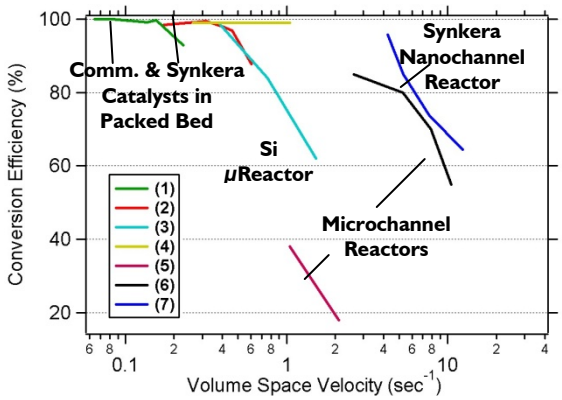
Methanol steam reforming with high space velocity and hydrogen yield of up to 5 sccm per 1x1x0.01 cm^3 planar reactor has been confirmed. A detailed performance summary is available on request.



100 µm-thick nanoporous ceramic membrane and micrograph of highly uniform cylindrical nanoreactors



Prototypes of catalytic nanochannel reactors with metallic rim to facilitate sealing and integration.



Conversion efficiency vs. space velocity for methanol steam reforming with Synkera nanochannel reactors vs. packed bed (expt) and microreactors (lit. data).

PARTNERSHIP DEVELOPMENT

We seek partners to support application development, validation and commercialization of this technology. Areas of interest include hydrogen generation for fuel cells and other applications. If you would like to discuss this further or need additional information, please contact:

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