Technology Readiness Level: 4
Component and/or Breadboard Validation in Laboratory Environment

Eltron Research & Development

Tech Brief

Eltron's Low CO_2 Emission Fischer-Tropsch Catalyst

Eltron's FTS materials show high conversion with significant Reverse Water-Gas Shift (RWGS) activity. This RWGS activity allows for high conversion to synthetic crude with a variety of feedstocks, while reducing the amount of CO_2 emissions. Fischer-Tropsch catalysts with high RWGS activity are ideal where excess is CO_2 present in the syngas mixture or when the H_2/CO ratio produced from gasification is higher than needed.

Benefits

- Higher chain growth probability (α) than precipitated iron and comparable to that demonstrated by supported cobalt.
- Higher overall yield of non-CO_2 products than baseline iron
- Lower CO_2 yield than baseline iron catalyst
- Less sensitivity to H_2:CO yield than baseline cobalt catalyst
- Cost comparable to baseline precipitated iron catalyst and much lower than supported cobalt

Features and Benefits

In our benchmark tests versus the state-of-the-art baseline precipitated iron and cobalt catalysts, the Eltron catalyst showed:

- Higher chain growth probability (α) than precipitated iron and comparable to that demonstrated by supported cobalt
- Higher overall yield of non-CO_2 products than baseline iron
- Lower CO_2 yield than baseline iron catalyst
- Less sensitivity to H_2:CO yield than baseline cobalt catalyst
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Figure 1. Photograph of reactor containing FTS wax after reaction of simulated syngas over Eltron's patented catalyst.

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Eltron's FTS catalyst allows for flexibility in the syngas feed composition while maintaining high FTS activity. The RWGS activity of the catalyst converts CO_2 in FTS products.

Stage of Development

This technology has ongoing funding from the U.S. Department of Energy.
Eltron has a related patent filed with the USPTO, 7,393,876 *Fischer-Tropsch Catalysts.*

Comparison Eltron's FTS Catalyst with Iron-Based and Cobalt-Based Catalysts			
Catalyst	**$Fe/Cu/K/SiO_2$**	**Co/Al_2O_3**	***Eltron Catalyst***
Activity	0.3 Kg HC/hr. Kr cat.	0.7 Kg HC/hr. Kr cat.	*0.6 Kg HC/hr. Kr cat.*
Mechanical Strength (Durability)	Poor to Moderate	High	*Moderate to High (anticipated)*
Relative Lifetime	1	4	*Unknown – probably 2-4*
Separability from Products	Poor	Good	*Unknown*
Sensitivity to Water	High	Low	*Moderate*
Water Gas Shift Activity	High	Low	*Moderate*
H_2:CO Ratio	06.-1.5	1.5-2.2	*0.6-2.2*
Relative Cost of Catalyst Metals/Wt.	1	230	*2*
Sensitivity to Feed Composition	Low	High	*Moderate*
Olefin/Paraffin Ratio	High	Low	*Medium*
Carbon Number Distribution	Lower C-number	High C-number	*High C-number*
Byproducts	CO_2 + H_2O + Electric Power	H_2O + Electric Power	*Lower CO_2 + H_2O + Electric Power*

Summary of Key Non-Proprietary FTS Data

In the following data, the CO_2 produced is in excess of the amount fed to the reactor.

Reaction Conditions: H_2/CO=1.6; 250℃; 250 psig; Data after 65-69 hr on st ream; *No CO_2*			
Catalyst	**CO Conversion, %**	**CO_2 Produced, %**	**CH_4 Produced, %**
State-of-the-Art PPT-Fe	91	48	4.0
Eltron's Patented Catalyst	76	38	3.4
State-of-the-Art Cobalt	69	11	4.6
Reaction Conditions: $H_2/CO/CO_2$ = 37.5/25.0/37.5; 250℃; 250 psig; *CO_2 in Feed*			
Catalyst	**CO Conversion, %**	**CO_2 Produced, %***	**CH_4 Produced, %**
State-of-the-Art PPT-Fe	83	29	2.4
Eltron's Patented Catalyst	74	**-37**	4.0
State-of-the-Art Cobalt	86	2	25.0
RWGS Data† - Reaction Conditions: H_2/CO_2 = 1; 250℃; 250 psig; *No CO*			
Catalyst	**CO Produced, %**	**CO_2 Conversion, %**	**CH_4 Produced, %**
Eltron's Patented Catalyst	6	**37**	3.1

* CO_2 produced is in excess of the amount that was fed to the reactor.

† State-of-the-art PPT-Fe and Cobalt catalysts have NO Reverse Water-Gas Shift activity.

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Eltron Research & Development Inc.

Eltron Research & Development Inc. commercializes novel technologies involving advanced materials, energy, water and environmental systems.

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