



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

Eltron's Low CO₂ 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 CO₂ emissions. Fischer-Tropsch catalysts with high RWGS activity are ideal where excess CO₂ is present in the syngas mixture or when the H₂/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-CO₂ products than baseline iron
- Lower CO₂ yield than baseline iron catalyst
- Less sensitivity to H₂: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
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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 CO₂ 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*.

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Figure 1. Photograph of reactor containing FTS wax after reaction of simulated syngas over Eltron's patented catalyst.

Comparison Eltron's FTS Catalyst with Iron-Based and Cobalt-Based Catalysts			
Catalyst	Fe/Cu/K/SiO₂	Co/Al₂O₃	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	0.6-1.5	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 ₂ O + Electric Power	H ₂ O + Electric Power	Lower CO ₂ + H ₂ O + 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: H₂/CO=1.6; 250°C; 250 psig; Data after 65-69 hr on st ream; No CO₂			
Catalyst	CO Conversion, %	CO₂ Produced, %	CH₄ 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: H₂/CO/CO₂ = 37.5/25.0/37.5; 250°C; 250 psig; CO₂ in Feed			
Catalyst	CO Conversion, %	CO₂ Produced, %*	CH₄ 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: H₂/CO₂ = 1; 250°C; 250 psig; No CO			
Catalyst	CO Produced, %	CO₂ Conversion, %	CH₄ Produced, %
Eltron's Patented Catalyst	6	37	3.1

* CO₂ 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.



Eltron Research & Development Inc.

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