Synfuels China CTL Technologies

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SFC Background

Synfuels China (SFC)

- Established in 2006
- Registered Capital: 1b RMB

SFC R&D Centre
Beijing & Taiyuan

more than 80 patents

SFC Engineering Co., Ltd.
Beijing

Catalyst Factories
Anhui & Inner Mongolia

SFC Inner Mongolia Co., Ltd.

PhD 41
Mater 121
Bachelor 252
Others 150

Synfuels China (SFC)
A unique integrated system has been established in SFC to facilitate the R&D and commercialization of SFC technologies.
SFC R&D on F-T Catalyst

Fe 
Fe$_4$C 
Fe$_3$C 
Fe$_5$C$_2$ 
Fe$_7$C$_3$ 
Fe$_2$C 
Fe$_3$O$_4$ 
Fe$_2$O$_3$ 

Experimental Characterization

Quantum Chemistry

Detailed Reaction Mechanism

Kinetics Study

Catalyst Design

Process Scaling Up

Molecule Simulation

Experimental Characterization → Quantum Chemistry → Detailed Reaction Mechanism → Catalyst Design → Process Scaling Up
CO + 2H₂ → (-CH₂-) + H₂O
ΔH = -165 kJ/mol (-CH₂-)

CO + H₂O → CO₂ + H₂
ΔH = -41.3 kJ/mol (CO)

Catalyst Features:
- high activity
- excellent selectivity
- high attrition resistance
SFC HTSFTP can be integrated with various commercial gasification technologies using different feedstocks such as coal, natural gas, biomass, etc.
Scaling Up of F-T Slurry Reactor

Process Parameter
- capacity, gas velocity

Case Dimension, internals requirement

Internals Design
- cold experiment allocation
- heat exchangers

Material
- manufacture
- field assembly
- installation

Lab. 1.0L
Pilot 0.3m
Demo 5.3m
Commercial 9.6m

9.6 m reactor technology

OUR EXPERTISE ENERGY IN FUTURE 我们的事业，能源的未来
Three Demon Plants Using HTSFTP

- **Yitai CTL plant**: coal-water slurry gasifier, 160 kt/a, Inner Mongolia
- **Luan CTL plant**: fixed bed gasifier (Lurgi), 160 kt/a, Shanxi
- **Shenhua CTL plant**: Shell Gasifier, 180 kt/a, Inner Mongolia
- All three plants: constructed 2005 - 2008, commissioned in 2009
- F-T Reactor Diameter: 5.3m (Yitai), 5.8m (Luan & Shenhua)
Features of Yitai CTL Demon Plant

- Total conversion of (CO+H2): ~ 92%
- Total Heat Efficiency: 40.53%
- Running at 100-120% of full load since June 2010
- Catalyst productivity: 1,000-1,400 t oil/t catalyst
- Catalyst space velocity: 1.0-1.4 g oil /gcat h
- C₅+ selectivity: 90 - 94%
- Oxygenates selectivity: 2.3 – 2.5%
Main consumptions:

Feed coal: ~3.48 ETC/t oil
Fresh water: ~13.45 t/t oil
Electricity: ~794.67 kWh/t oil
Equivalent energy: ~109.86 GJ/t oil
Catalyst productivity: 176~185 g C_{3+}/Nm^3 (CO+H_2)
(Theoretical 208.3)
Stepped Liquefaction

Fuel Gas

\[ \text{H}_2 \]

Catalyst

Coal

\[ \text{H}_2 \]

Drying

Coal-Oil Slurry Preparation

LP Steam

Coal-Oil Slurry Pre-treatment

\(< 5 \text{ MPa} \)

400–450 °C

Product Separation

Partial Hydrogenation

Product Upgrading

Gasification

F-T Synthesis

Syncrude

H2

Dry Gas

Light Oil

Hot Residual

Solvent Hydrogenation

Heavy Oil

\[ \text{H}_2 \]

Solvent

CO Shift

Gasification

Dry Gas

LPG

Fuels

Chemicals
SFC CTL technologies have been selected for several large-scale CTL projects in China.

- **Yili, Xinjiang**
  - Bituminous/sub-bituminous
  - HTSFTP, 1 mt/a

- **Shenhua Ningmei**
  - Bituminous
  - sub-bituminous
  - HTSFTP, 4mt/a

- **Yufu, Guizhou**
  - Anthracite (low volatile)
  - HTSFTP, 2 mt/a

- **Luan, Shanxi**
  - Coking coal
  - Bituminous coal
  - (high sulfur, High ash, High melting temp)
  - HTSFTP, 2 mt/a

- **Dalu, Inner Mongolia**
  - Stepped Liquefaction, 2 mt/a
  - HTSFTP, 2 mt/a
  - Brown coal

- **Yili, Xinjiang**
  - Bituminous/sub-bituminous
  - HTSFTP, 1 mt/a

- **Yifeng, Inner Mongolia**
  - Bituminous/sub-bituminous
  - HTSFTP, 2 mt/a

**Diagram:**

- Red triangle indicates approved projects.
- Blue triangle indicates pre-approved projects.

**Map:**

- Key locations and projects marked on the map of China.

**Note:**

- SFC CTL technologies have been selected for several large-scale CTL projects in China.
Conclusions

◆ A seamless integrated system has been established in SFC to facilitate the R&D and commercialization of SFC CTL Technologies.

◆ SFC’s proprietary High Temperature Slurry F-T Process (HTSFTP) Technology has been successfully applied in three 160 kt/a CTL demon plants in China.

◆ Ningmei 4mt/a (100,000 bpd) CTL project using SFC HTSFTP technology is under construction in China, to be commissioned in 2016.
THANK YOU