Synfuels China CTL Technologies

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Synfuels China (SFC)

- Established in 2006
- Registered Capital: 1b RMB

- PhD 41
- Mater 121
- Bachelor 252
- Others 150

SFC Background

- more than 80 patents

SFC R&D Centre
Beijing & Taiyuan

SFC Engineering Co., Ltd.
Beijing

Catalyst Factories
Anhui & Inner Mongolia

SFC Inner Mongolia Co., Ltd.
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
Fe₄C
Fe₃C
Fe₅C₂
Fe₇C₃
Fe₂C
Fe₃O₄
Fe₂O₃
……

Experimental Characterization

Quantum Chemistry

Detailed Reaction Mechanism

Kinetics Study

Catalyst Design

Process Scaling Up

Molecule Simulation
SFC HTSFTP

Our expertise, energy in future

Cooling Water

Steam

Fresh Syngas

Recycling gas

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
Optimized Integration of Processes

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

9.6 m reactor technology

Lab. 1.0L
Pilot 0.3m
Demo 5.3 m
Commercial 9.6 m
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)
- 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: \(176\sim185\) g C\(_3^+\)/Nm\(^3\) (CO+H\(_2\))
  
  (Theoretical 208.3)
Stepped Liquefaction

Fuel Gas

- H₂
- Catalyst

Coal

- Drying
- Coal-Oil Slurry Preparation

LP Steam

Coal-Oil Slurry Pre-treatment

< 5 MPa
400-450 °C

Product Separation

Dry Gas

Light Oil

Solvent

Heavy Oil

H₂

Solvent Hydrogenation

Gasification

CO Shift

F-T Synthesis

Product Upgrading

Dry Gas

LPG

Fuels

Chemicals

OUR EXPERTISE ENERGY IN FUTURE 我们的事业，能源的未来
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, 4 mt/a

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

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

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

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