Fischer-Tropsch Synthesis

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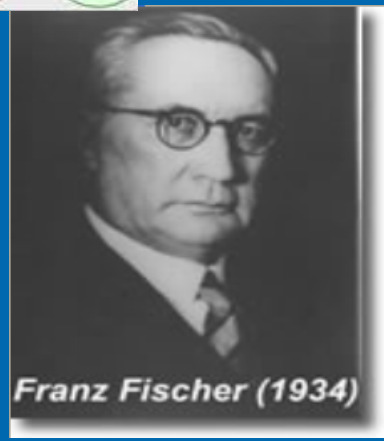

Turn Coal into Oil…

Through Fischer-Tropsch synthesis. In Fischer-Tropsch synthesis carbon monoxide and hydrogen (which can be obtained from coal, natural gas, and biomass) are reacted in the presence of a catalyst to create liquid hydrocarbons.

In the Beginning…

Germany had a high demand for oil, yet no natural deposits. They also had lots of coal. Frans Fischer and hans Tropsch discovered a way to turn what they had, coal, into what they needed, oil,

Today...

As oil prices approach $100/bbl, Fischer-Tropsch synthesis is exciting more and more interest. Why buy oil when you can make it for less?

The Support

What is needed?

- A highly pourus solid.
- A high surface area. Preferably above 80m^2/g
- Average pore diameter between 10nm and 15nm
- High thermal stability (up to 900 C)
- Able to be made into extrudates and pellets.
- Little or no support-metal interaction.

What material meets all theserequirements?

Gamma Alumina

Metals

Iron

- Descent activity and yields.
- Inexpensive
- High selectivity to olefins
- Catalyzes the water-gas shift reaction (for equation, see below).

$$CO_{(g)} + H_2O_{(g)} \rightleftharpoons CO_{2(g)} + H_{2(g)}$$

Comments: Due to iron's ability to catalyze the water-gas shift reaction, It is typically used when the feed gas is derived from coal or biomass where there is a relatively low H2 to CO ratio.

Cobalt

- Higher activity and yields
- Fairly expensive
- High selectivity to linear alkanes
- Doesn't catalyze the water-gas shift reaction.
- Longer life span

Comments: As a result of cobalts higher activity and longer life span, It is the perfered metal when using feeds that have a H2 to CO ratio closer to 2, like the synthesis gas that is derived from natural gas.

Typical Preparation Methods

Aqueous impregnation

- Can achieve high metal loadings in one impregnation
- Proceedure is simple and quick.
- Poor dispersion
- Strong metal support interactions

Ion exchange

- Deposition of metals is very uniform
- Only small metal loadings can be achieved, 2-3wt% maximum.
- Good for use with expensive noble metals.

Precipitation

- Can achieve high metal loadings
- Possible to achieve uniform distrbution.
- Some of the metal can I nteract strongly with the support