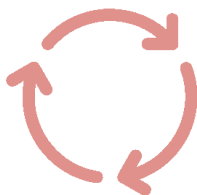


Fischer–Tropsch synthesis

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Fischer–Tropsch synthesis



Conditions



Temperature: 200-350°C
Pressure: 10-40 atm
Co, Fe or Ru as catalyst
Heterogenous Catalysis

Products



Aliphatic hydrocarbons
LPG (C₃ to C₄)
gasoline (C₅ to C₁₂)
diesel (C₁₃ to C₂₂)
waxes (C₂₃ to C₃₂)

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F-T synthesis: Societal Importance

Environmental Remediation



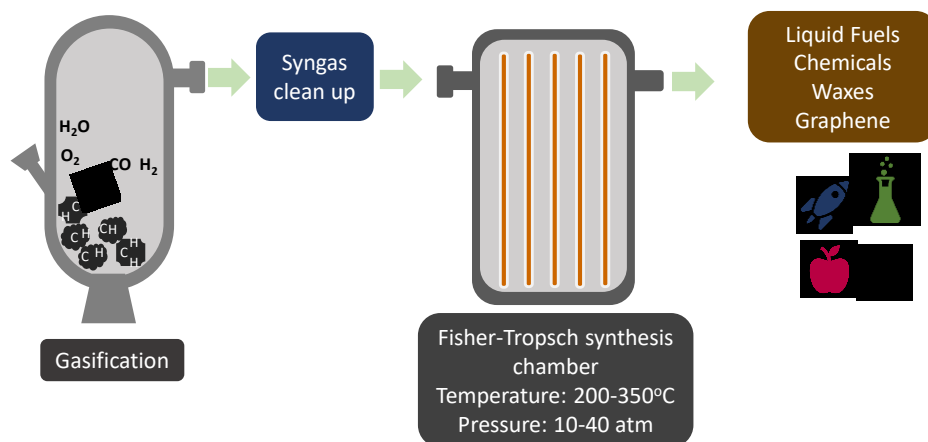
F-T synthesis can be used to transform carbon containing materials such as coal, biomass or even waste plastics to fuels, chemicals and other useful material such as clothes.



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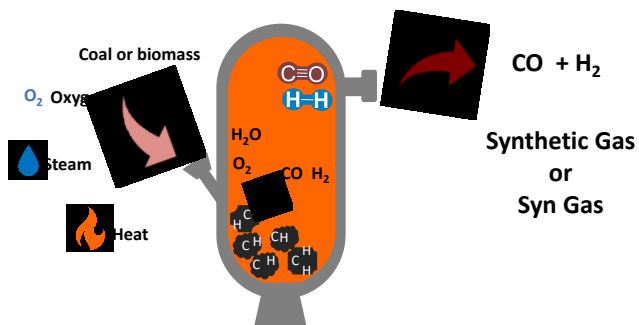
F-T Synthesis-based Production Scheme



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Gasification



Gasification is conversion of carbon containing materials such as coal, dried plants or even plastics to gases in limited oxygen supply and high temperature ($\sim 800^\circ C$ or more).

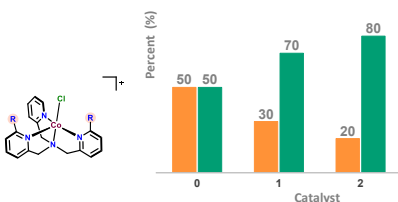
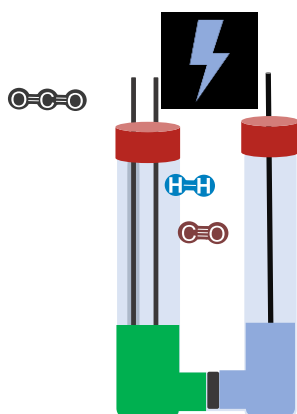
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Other Ways of Producing Syngas

Electrochemical CO_2 reduction to CO

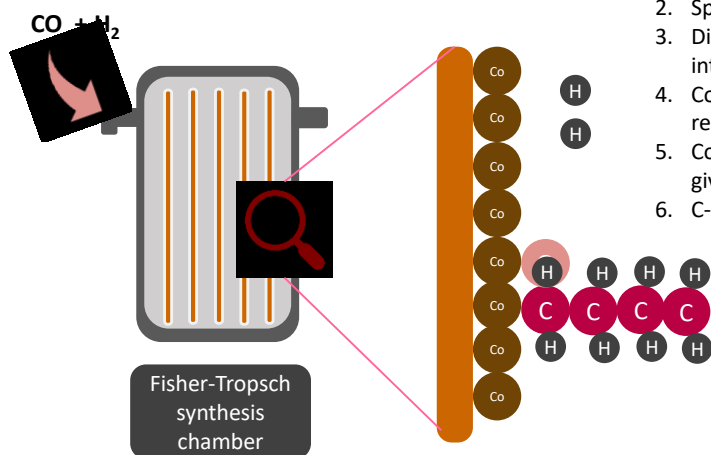
- Atmospheric CO_2 can be converted directly into syngas.
- Required only ambient conditions.
- Water act as proton source and also leads to H_2 production
- Transition metal catalysts can be used to generate the different ratio of H_2 and CO.



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F-T Synthesis in Detail: Mechanism



1. Associative adsorption of CO
2. Splitting of C-O bond
3. Dissociative adsorption of H_2 into 2H
4. Combination of 2H and O to release H_2O
5. Combination of 2H with C to give CH_2
6. C-C coupling, and chain growth



Summary

- F-T synthesis is the conversion of CO and H_2 to hydrocarbon over metal catalysts.
- Is an exothermic process and requires high pressure.
- Syngas can be produced by gasification or direct CO_2 reduction.
- CO dissociates on metal surface and react with dissociated hydrogen to form hydrocarbons
- F-T synthesis holds promise for clean energy production and thus for environmental remediation.

