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Two-stage hydrocarbon synthesis from hydrogen and carbon mon:oxide - uses relatively lower pressure in second stage and cobalt on alumina catalyst

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E(10-J2D) N(2-B, 2-E)

2-stage hydrocarbon synthesis process comprises:

(a) reacting, in a first stage, H_2 and CO in the presence of a supported Co or Ru catalyst and converting at least 50% (e.g. 60-70%) of the CO to C2+hydrocarbons at reaction conditions including a relatively higher pressure;

(b) recovering a reaction prod. comprising H_2 and CO, and separating liq. from this;

(c) reacting in a second stage the remaining reaction prods in the presence of a catalyst comprising effective amts. of Co supported on alumina at reaction conditions including a relatively lower pressure; and

(d) where the second stage catalyst is at least as active for CO conversion to C2+ hydrocarbons as the first stage catalyst at second stage conditions.

ADVANTAGES

The Co/alumina catalyst in the second stage is more active at lower pressures than other commonly used catalysts, so that intermediate compression of the unreacted synthesis gas from the first stage is avoided, thus reducing expense.

SPECIFICALLY CLAIMED

The second stage pressure is about the same as the first stage outlet pressure. First stage pressure is $\geq$ 10 atmos. and second stage pressure is $\leq$ 10 atmos..

The first stage catalyst comprises Co and Ru supported on silica, alumina, silica-alumina or titania. Other suitable promoters for Co are Re, Hf and Ce. Conventional catalysts are used.

The second stage catalyst contains 5-60 wt.% Co and is promoted with Re in Re:Co ratio > 0.5:1.

The H_2:CO ratio in each stage is 1.7:1-2.1:1.

The CO partial pressure at the second stage outlet is at least 0.3 atmos., esp. at least 0.7 atmos..

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