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Two-stage hydrocarbon prodn. from synthesis gas - using iron-contg. catalyst and cobalt- or ruthenium-contg. catalyst

Prodn. of hydrocarbons is carried out by
(a) contacting synthesis gas having an H_2/CO molar ratio of less than 1.0 with a Fe-contg. bifunctional catalyst or catalyst combination having both Fischer-Tropsch (FT) and shift conversion (SC) activity, and
(b) contacting the effluent from (a), or at least its H_2+CO component, with a Co- or Ru-contg. monofunctional catalyst having FT activity.

When the feed to step (b) has an H_2/CO molar ratio of less than 1.5, step (b) is effected in the presence of added H_2O using a Co- or Ru-contg. bifunctional catalyst or catalyst combination having both FT and SC activity.

ADVANTAGES

The process gives high conversions at high space velocities without the stability problems associated with the use of step (a) alone.

DETAILS

The synthesis gas pref. has an H_2/CO molar ratio greater than 0.25 and is produced by steam gasification of carbonaceous material at 900-1500°C and 10-100 bars.

The catalyst in step (a) is pref. a product obtained by (i) impregnating 100 pts. wt. alumina with 30-75 (esp. 40-60) pts. wt. Fe, 5-40 (esp. 7.5-30) pts. wt. Mg, 0.5-5 pts. wt. Cu and 1-5 pts. wt. K, followed by calcination at 700-1200 (esp. 50-850)°C and redn. at 250-350°C, or (ii) impregnating 100 pts. wt. silica with 10-40 (esp. 20-35) pts. wt. Fe, 0.25-10 (esp. 0.5-5) pts. wt. Cr and 1-5 pts. wt. K, followed by calcination at 350-750 (esp. 350-700)°C and redn. at 350-750 (esp. 350-500)°C.

Step (a) is pref. effected at 200-350 (esp. 250-350)°C and 10-70 (esp. 20-50) bars with a GHSV of 500-5000.

The FT catalyst in step (b) is pref. prepd. by impregnating 100 pts. wt. silica with 10-40 pts. wt. Co and 0.25-5 pts. wt. Zr, Ti or Cr, followed by calcination at 350-700°C and redn. at 200-350°C. The FT catalyst can be used in alternate layers with an SC catalyst.

Step (b) is pref. effected at 125-350 (esp. 175-275)°C and 1-150 (esp. 5-100) bars. (16pp367).