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83991 E/40 E36 H04 MONS 12.03.81  
 MONSANTO CO \*EP --61-260  
 11.03.82-EP-301237 (+243220) (29.09.82) C01b-03/50 C10g-47  
 C10g-49/22  
 Hydrocracking with hydrogen recycle after purificn. by membrane  
 sepn.

E(10-J2D) H(4-B3, 4-E6) N(6)

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to the hydrocracking zone as part of the H<sub>2</sub> feed gas.

ADVANTAGES

The process improves efficiency of H<sub>2</sub> utilisation.

DETAILS

The total pressure on the opposite side of the membrane (34) is pref. at least 8 atmos., and the product of R and the mole % of H<sub>2</sub> in the vapour phase from the 2nd separator (26) is pref. at least 200. The permeate (38) may have a higher H<sub>2</sub> content than the feed gas, pref. at least 80 vol.%, and pref. contains at least 70; of the H<sub>2</sub> supplied to the membrane.

The pressure in the 1st separator (20) is pref. 0.9-1 times the pressure in the hydrocracking zone (10). The temp. in the 2nd separator (26) is pref. less than 70°C.

If the hydrocracking effluent contains N<sub>2</sub>, the membrane should be selective for H<sub>2</sub> permeation over N<sub>2</sub> permeation. (27pp367).

(E) ISR: US3444072 US3445379 GB-837401 FR2265673

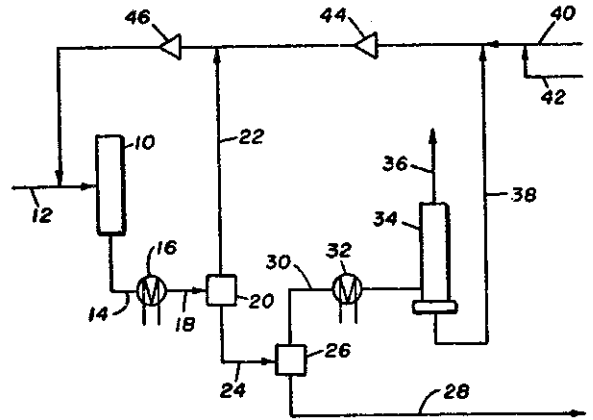
1 Jnl. Ref.

D/S: E(DE FR GB IT NL)

Hydrocracking of hydrocarbon feeds is effected by contacting the feed with a hydrocracking catalyst at a temp. of at least 250°C and a pressure (P1) of at least 75 atmos. (absolute) in the presence of H<sub>2</sub>.

The hydrocracking effluent is passed to a 1st gas-liq. separator operating at a pressure (P2) of at least 0.75 times P1. The liq. phase from the 1st separator is passed to a 2nd gas-liq. separator operating at a pressure (P3) between 35 atmos. and P2 to give a vapour phase with an H<sub>2</sub> concn. of at least 50 vol.% and an H<sub>2</sub> partial pressure of at least 20 atmos.

The vapour phase from the 2nd separator is contacted with the feed side of a polymeric membrane having an H<sub>2</sub>/CH<sub>4</sub> sepn. factor of at least 15, the ratio (R) of the total pressure on the feed side to that on the opposite side being at least 3:1. The resulting H<sub>2</sub>-enriched permeate is recycled



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 13.03.81-US-243273 (+243220) (29.09.82) C01b-03/50 C10g-47  
 C10g-49/22

Hydrocracking process with increased hydrogen utilisation - with recycle of hydrogen-rich stream obtd. by passing vapour from hydrocrackate through polymeric membrane

D/S: E(DE FR GB IT NL)

A catalytic hydrocracking process is claimed in which (a) a hydrocarbonaceous feed is hydrocracked in the presence of a catalyst and H<sub>2</sub> at at least 250°C and 45 ata, the reaction zone contg. a vapour phase (I) and a liquid phase and the H<sub>2</sub> being supplied by a feed gas contg.  $\geq 75$  vol.% H<sub>2</sub> in such amounts that the H<sub>2</sub> concn. in (I) is  $\geq 65$  vol.%, (b) the hydrocrackate is sepd. into liquid (II) and vapour (III) phases, (III) being at such a temp. and pressure that it is in equilibrium with (II) and has a greater H<sub>2</sub> concn. than the minimum H<sub>2</sub> concn. of (I), (c) contacting (III) with a polymeric membrane which is selectively permeable to H<sub>2</sub> compared with nitrogen or methane, and (d) withdrawing H<sub>2</sub> permeate from the low-pressure side of the membrane, compressing it and recycling it to the hydrocracking zone.

#### ADVANTAGES

The hydrogen utilisation efficiency is increased without

H(4-B3, 4-E6)

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deleterious effects on the operation of the hydrocracker. Furthermore, the throughput of hydrocarbon feedstock can be increased and the C5+ yield is also increased.

#### DETAILS

The pressure of (III) is pref. at least 0.5 (esp. 0.9-1) times the pressure in the hydrocracking zone. The temp. of (III) is pref.  $< 70^\circ\text{C}$  and (III) pref. contains at  $\geq 75$  vol.% H<sub>2</sub>. At least 5% of (III), and pref. all of it, is contacted with the membrane.

The membrane pref. operates with a pressure difference of  $\geq 20$  atmospheres, and  $\geq 50\%$  of the H<sub>2</sub> in the vapour on the feed side should permeate the membrane.

To produce (III), the hydrocrackate is pref. separated at elevated temp. into vapour and liq. and the vapour is cooled to below  $70^\circ\text{C}$  to form (II) and (III). (26pp909).

(E) ISR:- US3471397; US3733260; FR2265673.