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Fast exothermic catalytic reaction in the gas phase - is carried out by passing gases downwards and using inert liquid diluent

E(10-E4E, 10-J2D) H(4-E5) J(4-E1) N(2-C)

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A fast exothermic gas phase reaction is carried out by passing the gases downward mixed with an inert liquid diluent through a fixed bed of catalyst at a superficial gas and liquid phase velocity of at least 1.5 (pref. 3-20) cm/s.

USE/ADVANTAGE

The process is particularly suitable for redn. of CO with H_2 to give hydrocarbons, esp. methane and alcohols, esp. methanol, depending on the catalyst used. The heat stability of the reactor is greater than in other processes and this results in extended life of the catalyst. The absence of catalyst displacement, compared with a fluidised bed process, gives negligible attrition and no carrying away of fine particles of catalyst.

DETAIL

The inert diluent is pref. a hydrocarbon (fraction) or a heavy alcohol (mixt.) and has density 0.4-2 g/cm³ and viscosity 0.05-10 MPa.s in the reaction conditions. The catalyst particles are pref. 1-6 mm dia. and a suitable catalyst for methane prodn. is nickel.

EXAMPLE

Alumina balls 2 mm dia. with pore vol. 80 ml/100 g and bulk density 0.6 g/cm³ are impregnated with $Ni(NO_3)_2$, dried and calcined at 350°C for 4 hr. giving an NiO content of 15%. They are then activated with H_2 (5% in N_2) at 330-430°C. The liq. phase is 10-16C desulphurised paraffin of s.g. 0.85 at 20°C (about 0.6 at 330°C) and viscosity 0.12 centipoise (0.12 MPa.s). The reactor is 4 cm dia. and 100 cm high. Synthesis gas contg. CO/H_2 at 1:3 is mixed with the paraffin and fed downwards through the catalyst at 6 m³/hr. (4.2 cm/s) the paraffin being at the rate of 200 l/hr (4.5 cm/s). CO conversion is 97% and selectivity to methane 95% initially falling to 88% and 96% after 2000 hr run.(3pp942).