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Integrated coal liquefaction-gasification process with slurry recycle - with control of solids content and particle size of the recycle stream

D/S: N(BR, JA SU) E(DT, FR, GB, NL).

An integrated coal liquefaction/gasification process is claimed, the process employing recycle of a slurry, comprising normally solid dissolved coal and mineral residue and obtained from the liquefaction effluent separation system, to the liquefaction zone. The improvement relates to the control of the solids content in the recycle slurry when processing high-ash (contg. ≥ 15 , esp. ≥ 20 , wt.% inorganic mineral matter on a dry basis) feed coals.

Specifically, the liquefaction zone effluent is passed to a vapour-liquid separator where H_2 , hydrocarbon gases and naphtha are removed overhead. The residue slurry is split into three streams, the first (A) being recycled to the liquefaction zone, the second (B) to a product separator (including vacuum distillation means) and the third (C) to a hydrocyclone. The hydrocyclone provides an overhead slurry (I) comprising liquid coal and normally

solid dissolved coal contg. particles of suspended mineral matter having a median dia. smaller than that of the particles in (A), and an underflow slurry (II) of similar compsn. as (I) but with particles having a larger median dia. than the particles in (A). (I) is recycled to the liquefaction zone and (II) is passed to the product separator where liquid coal is removed leaving a gasifier slurry which is passed to the gasifier for conversion to H_2 (which is passed to the liquefaction) and to the synthesis gas which is used as a fuel in the integrated process.

ADVANTAGES

Reducing the net yield of normally solid dissolved coal imparts high efficiency to the process. The recycle slurry contains less than an aliquot wt. proportion of solids (compared to the gasifier feed slurry), but as these have a relatively small median dia. they are catalytically more active and thus maintain adequate catalytic activity despite the dilution. Alternatively, catalytic activity can be enhanced for a given solids concn.

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DETAILS

The median dia. of the particles in (A) is 1-10 μ and that of the particles in (I) is 0.5-5 μ . The residue slurry contains 5-40 wt.% solids and (C) comprises 10-75 wt.% of the total residue slurry. (I) contains 0.2-20 wt.% solids. (42pp920).

(E) ISR:US4102775; US4090943; US3962070; US3884796;
US3540995; 4 Journal References.