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 AIR PRODUCTS & CHEM INC \*EP-194-552-A  
 07.03.85-US-709157 (17.09.86) 80:1-23/78 C07c-01/04  
 Selective conversion of synthesis gas to diesel fuel - using uncalcined  
 catalyst of cupric and ferric hydroxide(s) impregnated with potassium  
 bicarbonate activated in reducing gas  
 C86-106089 E(BE DE FR GB IT NL)

E(10-J2D3) H(4-E5, 4-F2E) N(2-A, 2-D)

#### EMBODIMENTS

Cupric and ferric nitrate is coprecipitated with alkaline hydroxide, filtered and washed prior to impregnation with the salt. The coprecipitation is carried out at about 90°C and pH 5-9, and the coprecipitate dried at about 120°C in air or an inert atmosphere. The Gp. IA metal salt is potassium bicarbonate.

Synthesis gas, having a carbon monoxide to hydrogen mole ratio of 0.5:1 to 2:1, is converted to 9-25°C hydrocarbons by Fischer-Tropsch reaction in an improved process using a non-calcined catalyst produced by co-precipitation of ferric and cupric hydroxide and then impregnating the co-precipitate with a Gp. IA metal salt.

#### CATALYST ACTIVATION

The coprecipitate is activated for the catalysed reaction by exposure to inert gas at 100°-240°C for 1-24 hours with additional exposure to a hydrogen containing reducing gas, the pressure and temperature of the reducing gas being slowly increased to the desired temperature and pressure of the catalysed reaction, and the reducing gas is a 0.5:1 to 2:1 mole ratio mixture of carbon monoxide and hydrogen. The activation process comprises exposure to the inert gas followed by exposure to the reducing gas up to 240°C and 300 psig for 8-20 hours, and the reducing gas is a 1:1 mole mixture of carbon monoxide and hydrogen and the activation is carried out in the same reactor and immediately proceed ing the catalysed reaction.

#### USE/ADVANTAGE

Use of this catalyst enhances the overall thermal efficiency of the indirect liquefaction for producing hydrocarbon fuels from coal. The yield in the diesel fuel range is enhanced so improving the integration of the second stage Fischer-Tropsch reaction with the initial gasification step. The selective catalyst is stable over an extended period of time.

EP-194552-A

**CATALYST MANUFACTURE**

The catalyst is made by coprecipitating ferric and cupric hydroxide, impregnating the coprecipitate with an alkaline salt and then, while avoiding calcination of the impregnated coprecipitate, drying and activating the coprecipitate by exposure to an inert gas followed by a reducing gas at elevated temperature and pressure. The wt. percent elemental content of the catalyst, in dried unreduced form includes at least 50 percent iron, 0.01-5.0, pref. 0.1-2.0, most pref. 0.3-0.7 percent copper, and 0.01-5.0, pref. 0.1-1.0, most pref. 0.05-0.2, percent of a Gp IA metal.

**REACTION CONDITIONS**

The most preferred conditions are for (a) solid or entrained gas in catalyst phase, with carbon monoxide to hydrogen mole ratio of 0.9:1 to 1.6:1, temperature 220°-260°, pressure 150-500 psig, and space velocity of 186-650 per hour; or (b) slurry catalyst phase, with carbon monoxide to hydrogen mole ratio of 0.9:1 to 1.6:1, temperature 235°-260°C, pressure 150-500 psig, and space velocity of 150-1000 per hour. (17pp1684RKMHDwgNo0/4).

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EP 194552 A