Hydrogen and Syngas Generation from Hydrocarbons and Applications in Future Global Energy Management

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New catalysts based on carbided cobalt systems for the partial oxidation of hydrocarbons and for steam and dry reforming of natural gas (mainly methane) to syngas or hydrogen, then from syngas to synfuels will be described. A new general method of catalyst preparation using an aqueous organic matrix media (OMAX) enables us to control the deposition of the active component e.g., cobalt onto the support. This method has proved to be highly effective for the preparation of highly active and stable CPOX catalysts and also catalysts for gas to liquid processes. [1.2.3]. For the partial oxidation of methane, the carbided cobalt catalyst gives a thermodynamic equilibrium yield of hydrogen and carbon monoxide. Another cobalt catalyst prepared using the OMAX method, when treated with syngas at 192 ^{o}C, 30 bar and a GHSV of 1250 h^{-1}, 67% of CO yields a clean hydrocarbon mixture with a C_5^+ selectivity of 92%.

We have also discovered a unique catalytic process to extract hydrogen from methanol. A noble metal catalyst cause immediate reaction between methanol and hydrogen peroxide and generation of hydrogen gas and carbon dioxide (and *ca*. 80 ppm of CO). The hydrogen generation can commence at temperatures as low as -10 ^{o}C. This process for hydrogen gas preparation leaves no solid residues and in this respect is advantageous compared to currently available "cold start" methods.

A global energy strategy which is based on the premise that the best method to store hydrogen and to transport energy is to use hydrocarbons will be explained. In this strategy the hydrocarbons are made from renewable (green) sources and the required energy cycle would be carbon neutral to the environment would use some of the above catalysts.

Reference

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