Atmospheric Pressure Hydrocracking

Technology to reduce the pressure and temperature required in the hydrocracking of hydrocarbon feed stocks in GTL processes

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Background

Pressure is the biggest cost in the hydrocracking unit of a modern refinery. Gas compression expenses dominate the operational cost of existing units and pressure is the design parameter that necessitates enormous investments in building grassroots units.

Our contemporary need for carbon based energy is unquestioned, there is and there will likely never be an alternative for jet fuel in aviation. The moral imperative to live within the boundaries of our planet's ecology calls for a more efficient and reduced usage of the remaining fossil fuels immediately and for different sources such as natural gas in the intermediate and renewables in the long term.

Hydrocracking remains the only refinery process that can produce predominantly middle distillates such as diesel and aviation fuel, from fossil crude oil, from natural gas derived Fischer-Tropsch (FT) waxes, and from renewable oils alike.

Technology Overview

The invention is an atmospheric pressure hydrocracking process to produce middle distillates – kerosene and diesel – from an alkane rich feedstock. The ultra-low pressure – compared to the ubiquitous 150 bar in existing units – allows an operating temperature that is 100 °C to 150 °C lower than what is required by conventional hydrocracking catalysts.

Benefits

The invention provides the following advantages over conventional industrial hydrocracking processes:

- Atmospheric pressure reduces costs to such an extent that market entry and investment hurdles for grass roots hydrocracking units are entirely removed and that existing units become more profitable.
- The lower pressure and temperature requires and allows the use of noble metal loaded zeolite catalysts that are less prone to deactivation and thus have demonstrably longer cycle lengths.
- Yields of middle distillates from atmospheric pressure hydrocracking are higher than from conventional hydrocracking and product qualities such as pour point, freeze point and cetane index are improved.
- The invention further allows to co-process FT wax and product water as well as oils and water from hydrodeoxygenation (HDO) of renewables.

Applications

- The invention can be implemented with little or no further development in GTL refineries that process FT wax. This applies to large scale operations such as Sasol's Oryx GTL and Shell's Pearl GTL plants in Qatar as well as all other FT plants including small scale operations that are considered for sequestered natural gas sources.
- The invention dramatically simplifies designs for grassroots small-scale bio-refineries.
- The invention removes a big hurdle for compact bio-gas to fuels and renewables to fuels processing schemes.
- The invention is restricted to feedstocks low in aromatics, but after the first stage of a two stage hydrocracker aromatic content is very low in most units. The scope of this invention may thus include units that process highly paraffinic as well as naphthenic feedstocks in the second stage sweet loop of a two stage process.

Opportunity

The University of Cape Town invites interested parties to join our efforts in order to:

- Further develop and potentially implement the technology in existing GTL refineries.
- Develop novel plant designs for planned GTL refineries.
- Bring noble metal zeolite catalysts to the market thereby beneficiating the wealth of mineral resources of South Africa.
- Invest in further research activities at the University of Cape in order to broaden the scope of this new process to include crude oil refineries.

Patents

- GB 1811914.9

IP Status

- Provisional patent

Seeking

- Development partner
- Commercial partner
- Licensing