

CATALYTIC CRACKING OF PETROLEUM FRACTIONS

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Catalytic cracking is the thermal decomposition of petroleum constituents in the presence of a catalyst and discussions still remain about the influence of thermal decomposition as well as catalytic decomposition during the reaction. It is, essentially, the role of the influence of free radical species (thermal decomposition) and the influence of ionic species (catalytic decomposition) that may be in competition. Nevertheless, the reactions that run during catalytic cracking are complex but, as a result of advances in catalyst science with a better understanding of catalyst activity, there is a measure of predictability of the outcome of the process. Each type of constituent of the feedstock will undergo reactions that are specific to that type of chemical. For example, the major catalytic cracking reaction exhibited by saturated hydrocarbons is carbon-carbon bond scission into lighter saturated hydrocarbons and olefins. Bond rupture occurs at specific locations within the paraffin molecule, rather than at random locations as occurs in thermal cracking. For example, saturated hydrocarbons tend to crack toward the center and branch points of the molecule, the long chains cracking in several places simultaneously. In either case, catalytic cracking tends to yield products containing three or four carbon atoms rather than the one-carbon or two-carbon atom molecules produced in thermal cracking.

Feedstocks to the modern units now range from blends of gas oil fractions (included in normal heavier feedstocks for upgrading) to residua (reduced crude), heavy oil, and even tar sand bitumen. Fluid catalytic cracking is the most important conversion process used in petroleum refineries to convert the high-boiling feedstock constituents to more valuable naphtha, olefin gases, as well as other products and is likely to remain predominant in the refining industry for at least another three to five decades.

Catalytic cracking is a conversion process that was originally designed for gas oil but can also be applied to a variety of hydro carbonaceous feedstocks ranging from heavy oil, residua, and also to certain types of biomass-derived feedstocks [1–3]. The concept of catalytic cracking is the thermal decomposition of feedstocks constituents in the presence of a catalyst, which in theory, is not consumed in the process.

References:

1. James G. Speight, in *The Refinery of the Future* (Second Edition), 2020
2. Michael Niaounakis, in *Management of Marine Plastic Debris*, 2017
3. James G. Speight PhD, DSc, in *Heavy and Extra-heavy Oil Upgrading Technologies*, 2013