QUANTAÔ - Equilibrium Catalysts for Improved FCCU Margins

Achieve optimum activity and metals content for high performance operations

A Fluid Catalytic Cracking Unit (FCCU) is one of the most important industrial processes to convert petroleum to gasoline and other valuable products within a crude refinery. This process is based on a chemical reaction whose main purpose is to crack large molecules in the feed to lighter molecules that comprise products like gasoline and diesel. An FCCU is a major stepping stone in the historical evolution of refining processes because it allows for higher fuels yields than previously possible with less efficient methods like thermal cracking. In order to achieve this improvement in efficiency, FCCUs use a solid chemical (a catalyst) whose key objective is to accelerate the chemical reactions necessary to produce the highest amount of fuels with the minimum amount of energy.

This solid catalyst looks like a fine powder in part because it needs to be circulated pneumatically between different vessels in the FCCU with the use of air. Since this circulating inventory of catalyst is subjected to very high temperatures and the presence of steam as part of the process, with time it loses its potential to accelerate the chemical reactions and therefore it has to be replenished on a daily basis. Typical replacement rates are between 0.5 and 5% of the FCCU circulating inventory.

A typical FCC catalyst is mainly comprised of Silica (SiO_2) and Alumina (Al_2O_3) with minor amounts of other compounds.

Having emphasized about what an FCC catalyst is and its importance, we have to classify them into two main categories. There are 1) Fresh FCC catalysts; which are those that refiners purchase directly from catalyst manufacturers and 2) Equilibrium FCC catalysts, which are those withdrawn from FCC units after they have reached the required properties for a particular operation but that must be withdrawn to make room for fresh catalyst additions. We refer to these spent catalysts as “e-cats”. It is important to emphasize that the e-cat circulating in an FCCU is basically a blend of catalysts with different ages, i.e., some of the catalyst is very “young” (it just entered the unit) and some of it is “older” (it has been in the unit for a longer time).

Many refiners that have low levels of contaminants sell their spent catalysts to enhance the performance of other FCC units, typically processing dirtier feedstocks. There is a large global market in which e-cats are traded on a continuous basis.

In the next page, we explain how refiners are benefiting today from the use of e-cat.

FCCUs throughout the world consume feedstocks with different amounts of metals like Nickel and Vanadium. The metals in the feed are contaminants that deposit in the catalyst that is circulating in the unit, reducing its relative activity and affecting its selectivity, in other words, as the amount of metals in the circulating catalyst increase, it tends to produce more gas and carbon instead of high-value fuels like gasoline and diesel.

Here is where the use of e-cats becomes so valuable; for example, an FCCU consuming heavy feeds (like vacuum resids) with a lot of metals can reduce the amount of contaminants in their circulating catalyst by adding an external e-cat with a lower amount of metals in addition to their fresh catalyst. The benefits are: a) the amount of metals decline and b) the activity can be increased. Refiners can take advantage of this by allowing the catalyst to produce more fuels and/or by reducing the amount of fresh catalyst they use to save money.

In addition to the benefits explained above, Quanta Technologies has developed a patented process to modify the physical properties of an e-cat obtained from one FCCU before it goes into the next one, for example, Quanta can modify the particle size of the catalyst to improve the fluidization properties and/or to reduce catalyst losses to the atmosphere, helping refiners to comply with environmental regulations.

Furthermore, from time to time FCCUs need to purchase e-cat for start-up purposes. Therefore, access to an e-cat market is critical because every day a unit is down can represent millions of dollars in opportunity loses for a refinery.

Figure 1: Schematic of a typical FCC Unit

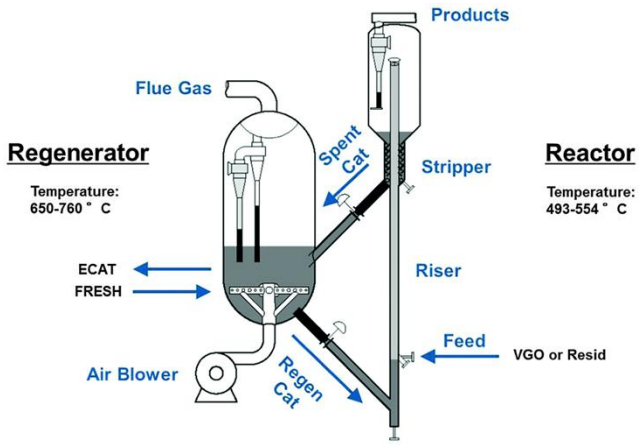

Figure 2: A sample of a typical FCC catalyst

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