Question 80: Does silica entering with the FCC feed have a negative impact on the performance of the catalyst or the product slate? Does the silica source matter? Does it matter if originated from crude oil production, antifoam injection in coker units, or from the crude itself? What proportion of the silica entering the FCC leaves with the product?

Dwight Agnello-Dean (BP)

I did not find any internally reported issues involving silica in FCC feed as a catalyst poison or as having negatively impacted product qualities. As a result, there have not been any attempts within BP to track silica in FCC feedstocks and in FCC products therefore I don’t have a basis for responding to the portions of this question requiring this kind of analysis. In regard to antifoam injection at the coker, our primary concerns are at the hydrotreating units processing coker naphtha followed the other hydrotreaters receiving heavier coker products. Efforts to minimize over injection of coker antifoam to protect the hydrotreating catalyst provide the added value of minimizing the siloxanes in the FCC feed. Our current practices do not monitor silica in our feeds, nor is it reported by our catalyst suppliers as part of the ecat testing program. In general, silica is not being treated as a contaminant of concern for our FCC units.

Ray Fletcher (Intercat)

There are many who feel that there is likelihood that silica will have an effect on the FCC catalyst with the likely mechanism being shell formation on the particle surface. There is a growing body of evidence that indicates that silica is mobile under regenerator hydrothermal conditions. This has been observed within Intercat by using high-resolution scanning electron microscopy with silica free additive injected into units running silica sol, alumina sol & alumina gel-based catalysts. It has been found that a significant silica shell is formed around these additives while present within a catalyst inventory based upon the silica sol technology. There is also a silica shell that is produced by alumina-based technologies but not as significant. Additionally, catalyst suppliers producing alumina-based FCC catalysts have observed silica shells on their catalysts when changing out from a silica-based system.

This phenomenon has been reproduced in the laboratory by steaming a silica free catalyst particle (such as a SOx additive) with a standard FCC catalyst. Micro-analysis by SEM/EDAX demonstrates that silica rich layer has been deposited on the surface of SOx additive microspheres. T

here is an expectation, although not verified, that formation of a silica shell around a catalyst particle will result in a barrier to mass transfer. It is possible that what is considered "typical" FCC catalysis has done influenced by silica shells for many decades.

It is believed that silica has a significant role in iron poisoning. This role shall be discussed in detail in

question 101.

Ruizhong Hu (Grace Davison Refining Technologies)

We are not aware of silica from crude oil or other source having a negative impact on the performance of an FCC catalyst. Silica is one of the main chemical components of a FCC catalyst, with a typical concentration of about 40-50%. It is known that silica in FCC catalyst is somewhat mobile under FCC regenerator conditions. Therefore, all FCC catalyst particles are subjected to a background of mobile silica already. Minor additional silica source, e.g. less than couple of percent, from crude or other source should not have a negative impact on the performance of a FCC catalyst.

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