Question 23: What are the sources of platinum loss in precious metals catalysts? What role can your refinery engineers play in minimizing this loss?

Troy Small and **Ka Lok** (UOP)

Typical operating conditions in a reformer do not result in platinum volitization. However, it is possible for Platinum to become volatile and come off the catalyst at very high temperatures. One place this can occur is in the Chlorination zone of the CCR Regeneration Tower, where slipping coked catalyst into an oxygen rich atmosphere can result in very high temperatures. To prevent this, the refiner should make sure that the regeneration tower is operated according to the design.

UOP's experience is that these questions often arise as the result of an assay difference with the reclaimer rather than volatilizing platinum. The assay differences can be due to unrepresentative sampling or poor/biased analyses.

Soni O. Oyekan (Prafis Energy Solutions)

In order to fully answer the questions, it is relevant in my brief response to separate the precious metal catalyst platinum management into five distinct stages to cover a platinum catalyst manufacture to spent catalyst platinum reclamation life cycle. The stages that are pertinent for our review are:

•Reforming catalyst manufacture by the catalyst supplier and platinum settlement

•Reforming catalysts storage and catalyst loading

•Catalyst as used in the reforming units

•Catalyst dumping and transfer to platinum reclamation company

•Platinum settlement with the platinum reclamation company

It must be clearly understood that platinum losses can occur at any of the stages of the catalyst cycle. Some of the losses are due to contractual agreements as agreed upon in the first and fifth stages as a consequence of platinum settlement. The platinum or precious metals manager for an oil refining company should have the necessary expertise to aid in minimization of platinum losses for the oil refiner for the first and fifth stages above. In the fresh catalyst manufacture stage, the agreement with the catalyst manufacturing company for platinum settlement could stipulate 98 % to 99.5 % platinum return for the settlements. The platinum settlement requires that the oil refiner and catalyst manufacturer or platinum reclamation companies for the platinum settlement have appropriate analytical data (platinum assay, LOI for solid content) to permit effective conduction of the platinum settlement. Some oil refiners conduct platinum settlement with the catalyst suppliers, and some do not. I recommend conducting fresh catalyst platinum settlements to establish a reference initial platinum in use for the specific process unit

that would be utilizing the fresh catalyst load and that the nominal platinum concentrations not be relied on as indicative of the reference fresh catalyst platinum. In the years that I managed precious metals for two oil refiners as a refinery technologist, several excess platinum troy ounces were returned to my companies' platinum pool accounts after fresh catalyst platinum settlements with the catalyst manufacturers. In addition, the fresh catalyst platinum settlement data provided a good reference basis for the subsequent platinum inventory in the reactors after the catalyst loading.

In the spent catalyst platinum reclamation, a similar legal agreement could stipulate another 98 to 99 % platinum settlement with some additional platinum percent penalties for coke, catalyst alumina state (alpha or delta) and metals impurities. Thus, based on the two platinum settlements for fresh and spent catalyst for a catalyst life cycle, platinum losses due to contractual agreements and lack of the appropriate level of platinum management expertise by the oil refiner could lead to platinum losses in the range of 3 to 5 wt. % for the oil refiner.

Major additional significant losses could occur in stages 2 to 4 listed above. These combined areas of catalyst loading, in unit catalyst usage, catalyst dumping, and precious metals management are so intertwined and extensive that I strongly recommend securing the services of experienced technical experts who understand clearly the three major catalytic reforming technologies – semi regen, cyclic and continuous catalytic regeneration reformers and how their operations could greatly contribute to significant platinum losses. If you also own paraffin isomerization units and other process units that use platinum catalysts seek the assistance of a technical expert who fully understands platinum or precious metals management as well as the operations of the relevant oil refining process units that utilize platinum catalysts. An excellent oil refining expert could also work with your engineers and other relevant oil refinery personal on proactive steps for cost efficient catalyst management, process monitoring, and optimization and equipment management to minimize platinum losses.

Tags

Catalysts

Catalytic Reforming

Isomerization

Naphtha Hydrotreating

Operations

Optimization

Process

Reactor Vessel

Reforming

Regenerator

Year

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