Question 74: In your experience, what are the effects of different Ni passivation technologies on the performance of CO promoters and stack emissions?

ZACH BEZON [United Refining Company (URC)]

Nickel passivation can be accomplished a few ways: antimony, bismuth, or sulfur. Adding antimony or bismuth in a solution, such as LCO, will immediately begin to passivate the negative effects of nickel poisoning. Antimony is considered a fugitive emission and may be hazardous; bismuth may be the safer option. Antimony decreases the effect of CO promoter; additionally, it can lead to elevated NOx emissions. Refinery fuel gas containing H2S can be used as lift gas and act as a temporary nickel passivator in the reactor, helping to reduce hydrogenation reactions. However, this effect is only temporary and will lead to elevated levels of nickel if nothing further is done.

CHRIS CLAESEN (Nalco Champion)

Pt promoters are sometimes used to oxidize CO to CO2in the regenerator. Antimony can passivate platinum promoters, which can result in afterburn and the need to use more platinum promoter. The Pt promoter oxides nitrogen compounds, as well as CO; so, the more Pt promoter that is used, the higher the NOx. Therefore, Sb (antimony) can theoretically result in higher NOx. Units using a Pt-based combustion promoter can consider a switch to one of the non-Pt combustion promoters if they want to eliminate the effect of increased NOx generation.

DENNIS HAYES (Nalco Champion)

Antimony-based additives are known to be effective at nickel passivation, but they have also been reported to reduce the effectiveness of CO promoter additives, resulting in increased usage of the additives.

ALEXIS SHACKLEFORD and **BILGE YILMAZ** (BASF Corporation)

Using antimony for Ni passivation will make CO promoters less effective. For example, one unit running 1000 ppm e-cat (equilibrium catalyst) Ni started using antimony, targeting a 0.35 Sb/Ni ratio. They had to increase their CO promoter additions from 1.1 ppm platinum (Pt) in inventory to 1.6 ppm Pt, or 50%. Running economics around unit profitability, the refinery found that using antimony improved profitability by 0.15 $/bbl (cost per barrel) due to lower hydrogenand coke. Even though this unit had relatively low Ni at 1000 ppm and had to use more CO promoter, the benefit of antimony at 0.15 $/bbl was significant,

and they continued to use antimony.

For units that have operational challenges using antimony, Ni passivation based on catalyst technology is an attractive route. For example, the use of boron-based technology (BBT),developed by BASFand used in our catalyst BOROCAT™, has been demonstrated successfully in commercial operations to passivate Ni without impacting stack emission or CO promoter efficacy.

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