Question 24: For a hydrocracker with a debutanizer/stabilizer column, what corrosion issues do refineries experience in the feed and/or overhead systems? What have you done to mitigate the corrosion? What are your key considerations in optimizing these parameters

Vern Mallett (UOP)

This answer assumes that the Debutanizer column is the first fractionation column design. In such columns, corrosion of the column bottoms, bottom outlet piping, reboiler tubes, fractionator feed heater tubes and the downstream fractionator is possible due to poor stripping of H2S. A minimum amount of vapor must be generated in the Reboiler to get sufficient V/L traffic below the feed tray for adequate H2S removal. The problem is that the relatively heavy Debutanizer bottoms liquid must be boiled to generate the stripping vapor. At the operating pressure of the Debutanizer, this can generate quite high Reboiler outlet temperatures. Also, it is not easy to determine how much vapor is being generated. If the Reboiler firing according to the outlet temperature, does not ensure sufficient vapor generated, because this will depend on the distillation curve adjusted for the operating pressure. The bottom line is that H2S stripping is very inconsistent, particularly for upset conditions. The result is corrosion in the equipment and systems mentioned above. It has been found beneficial, particularly for maximum distillate units to recycle some light naphtha to the Debutanizer feed in order to keep sufficient light material in the column bottoms so that sufficient vapor can be generated at a reasonable Reboiler outlet temperature. It is also recommended that bottoms piping, Reboiler tubes and fractionator feed heater tubes be at least 9% Cr material and the downstream fractionator should be lined up to the diesel draw tray. It may also be necessary to line the top of the fractionator because of the possible occurrence of a wet H2S environment, particularly for a steam stripped fractionator.

Michael Chuba (Sunoco)

Our Hydrocracker is configured with a preflash column followed by a main fractionator which fractionates out the light and heavy hydrocrackate. Originally the preflash tower was designed with a thermosyphon reboiler driven by a hot oil circulation system. This thermosyphon reboiler had historical problem with iron sulfide fouling which resulted in significant heat transfer loss and inability to properly strip the bottoms material feeding the main fractionator. This under-carry of H2S would lead to not only corrosion issues in the overhead system of the main fractionator, but also trace amounts of H2S in the hydrocrackate streams feeding the catalytic naphtha reformers.

To mitigate this problem a project was implemented to convert the thermosyphon reboiler to a forced system. Bottoms recirculation pumps were installed and the reboiler exchanger service was switched from having the process fluid on the shell side to tube side. This prevented any corrosion material from lying down and fouling the shell side. In addition, this modification allowed for a more stable control of heat input to the column since both the circulation rate and reboiler return temperature could be more finely controlled.

Since commissioning of the system, significant improvements in the preflash tower operation have been observed. The fouling of the reboiler, which in the past would limit capacity and result in H2S under-carry, has been significantly reduced.

Paul Fearnside (Nalco Company)

The hydrocracking debutanizer/stabilizer corrosion issues are determined by how well the upstream water wash is performing in minimizing the amount of corrosion precursors and carryover into the debut/stabilizer. The main corrosion mechanisms are driven by ammonium bisulfide, cyanide, and wet H2S. Less frequently, upstream oxygenated wash water has been the culprit. Determining which corrosive is involved is key to what mitigation strategy is used. Most common is a filmer, with a slipstream, injected into the debut/stabilizer OVHD vapor line. Less common is an oxygen scavenger into the upstream water wash.

Sam Lordo (Nalco Company) Typical anticipated corrosives in these tower overhead systems are NH4HS, Nh4Cl, Wet H2S, and Cyanide. Protection can be addressed using metallurgy, waterwash upstream or in the tower ovhd circuit, and chemical additives such as, filming amine corrosion inhibitors, metal passivators and salt dispersants. A good monitoring program supported by water analysis and corrosion probe or other corrosion monitoring methods (i.e., UT, RT, H2 permeation, etc.)

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