Question 26A: What is important for feedstock selection for a hydroprocessing unit regarding incompatibility? What related concerns are there in a heavy gasoil resid unit? What feedstock quality parameters are used to predict and /or prevent these issues?

GRANT YOKOMIZO and JOHN PETRI (Honeywell UOP)

A hydroprocessing unit can be designed to handle all potential feedstocks when there is a detailed understanding of the feedstocks' characteristics. Specifically feedstock selection regarding incompatibility limits needs to be considered as a broad and complex balance inherently linking with design choice for hydrogen addition in distributed product streams. In reality the selection is subject to choice of reactor configuration (e.g., fixed bed, fluidized or slurry), process target (cracking conversion, or product heteroatom content) as well as process conditions (catalyst usage or life cycle for fixed bed, pressure levels). Frequently incompatibility can be more limiting depending on the objective of a process, e.g., deeper cracking conversion is frequently found more limiting when hydrogenation is aggressively sought for cleaner and more saturated product as design priority, exemplified by fixed bed resid hydrotreating and fluidized bed resid hydrocracking scenarios. Bitumen residues may be potentially high in particulates based on the process of removal from tar sands.

In any residue conversion process, asphaltene precipitation can occur at higher conversions when the components that keep asphaltenes in solution are saturated and/or converted to lower boiling points. In addition, the cracking of asphaltenes makes them smaller and more polar increasing the propensity to precipitate. The feed selection in higher conversion processes needs to keep this phenomenon in consideration. More aromatic feeds will help keep asphaltenes solubilized. Process conditions (severity, catalyst type and use) related to hydrogen addition to bulk product affect reactor solvency thus stability. Clarified slurry oils or other highly aromatic feeds can be added into residue processes with significant conversion to improve the solubility of asphaltenes and enable higher conversion with reduced precipitation. However, clarified slurry oils may also contain significant concentration of FCC fines.

Bottoms sediment and water ("BSW") analysis can be used to identify the potential range of concentration of particulates. Laser refractometry can be used to identify the particle size distribution. For example, a sample can be ashed, particulates suspended and sonicated, followed by particle size distribution measurement. The pressure drop media can be selected and the pressure drop mitigation system can be designed to remove particulates externally or internally to the hydroprocessing unit. Additional media ought to be carefully considered, pending characterization of other contaminants in the feed components, e.g. Si, As, Ni, V, alkali metals, etc. Other feeds having a relatively higher Total Acid Number ("TAN") can internally create metal carboxylates and internal particulate generation after conversion to the metal sulfide.

Bulk properties of vacuum residues do not necessarily indicate the entirety of coking potential and deactivation. NMR and high resolution mass spectrometry of deasphalted oils and vacuum residue can be used to indicate the fused aromatic ring size and the extent of alkylation. The larger fused rings have a higher coking potential.

Print as PDF:

Tags

Coke

Year

2019

Submitter

Operator