commonly used as feedstocks for further refinery processing (e.g. Fluid Catalytic Cracking Units or FCCUs) that transforms them into transportation fuel blend stocks.

[0004] Crude oil refineries have regularly increased the use of heavier crudes in their crude blends due to greater availability and lower costs. These heavier crudes have a greater proportion of the heavier hydrocarbon components, increasing the need for coker capacity. Thus, the coker often becomes a bottleneck that limits refinery throughput. Also, these heavier crudes often contain higher concentrations of large, aromatic structures (e.g. asphaltenes and resins) that contain greater concentrations of sulfur, nitrogen; and heavy metals, such as vanadium and nickel.

[0005] As a result, the coking reactions (or mechanisms) are substantially different and tend to produce a denser, shot (vs. sponge) coke crystalline structure (or morphology) with higher concentrations of undesirable contaminants in the pet coke and coker gas oils. Unfortunately, many of the technology improvements attempting to deal with the above (plant capacity / bottlenecks, feedstock compositional changes, etc.) have substantially decreased the quality of the resulting pet coke. Most of the technology improvements and heavier, sour crudes tend to push the pet coke from porous sponge coke to shot coke with higher concentrations of undesirable impurities. The resulting shift in coke quality can require a major change in coke markets (e.g. anode to fuel grade) and dramatically decrease coke value. The changes in technology and associated feed changes can result in decreased quality of the fuel grade coke, having lower volatile matter and gross heating value, among other properties, making the produced fuel grade coke less desirable.

SUMMARY OF THE CLAIMED EMBODIMENTS

[0006] In one aspect, ~~embodiments disclosed herein relate to~~there is provided a process for upgrading residuum hydrocarbon feedstocks. The process ~~may~~ includes: contacting a residuum hydrocarbon and hydrogen with a hydroconversion catalyst in an residuum hydroconversion reactor system; recovering an effluent from the residuum hydroconversion reactor system; separating the effluent from the residuum hydroconversion reactor system to recover two or more hydrocarbon fractions including at least a vacuum residuum fraction and a heavy vacuum gas oil fraction; combining at least a portion of the heavy vacuum gas oil fraction and at least a portion of the vacuum residuum fraction to form a mixed heavy hydrocarbon fraction; feeding

at least a portion of the mixed heavy hydrocarbon fraction to a coker; operating the coker at conditions to produce anode grade green coke and distillate hydrocarbons; recovering the distillate hydrocarbons from the coker; fractionating the distillate hydrocarbons recovered from the coker to recover three or more hydrocarbon fractions including a light distillates fraction, a heavy coker gas oil fraction, and a coker recycle fraction.

[0007] In another aspect, ~~embodiments herein relate to~~there is provided a system for upgrading residuum hydrocarbon feedstocks. The system ~~may~~ includes: a residuum hydroconversion reactor system for contacting a residuum hydrocarbon and hydrogen with a hydroconversion catalyst; a fractionation system for separating an effluent recovered from the residuum hydroconversion reactor system into two or more hydrocarbon fractions including at least a vacuum residuum fraction and a heavy vacuum gas oil fraction; a mixing device for combining at least a portion of the heavy vacuum gas oil fraction and at least a portion of the vacuum residuum fraction to form a mixed heavy hydrocarbon fraction; a coker for converting the mixed heavy hydrocarbon fraction to produce anode grade green coke and distillate hydrocarbons; a fractionation system for fractionating the distillate hydrocarbons recovered from the coker into three or more hydrocarbon fractions including a light distillates fraction, a heavy coker gas oil fraction, and a coker recycle fraction.

[0008] Other ~~aspects~~ disclosures and advantages will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Figure 1 is a simplified process flow diagram of a process for upgrading residuum hydrocarbon feedstocks according to embodiments disclosed herein.

[0010] Figure 2 is a simplified process flow diagram of a process for upgrading residuum hydrocarbon feedstocks according to embodiments disclosed herein.

[0011] Figure 3 is a simplified process flow diagram of a portion of a process for upgrading residuum hydrocarbon feedstocks according to embodiments herein.

[0012] Like numerals represent like parts throughout the figures.

DETAILED DESCRIPTION

[0013] In one aspect, embodiments herein relate generally to processes for upgrading vacuum residuum streams derived from petroleum, tar sands, shale oils, coal liquids,