CLAIMS

1. A pyrolysis process, comprising:

desalting a hydrocarbon feed, wherein

(i) the hydrocarbon feed comprises hydrocarbon, at least one halogen-containing composition, and at least one metal-containing composition,

(ii) the halogen-containing composition and the metal-containing composition are different, wherein the metal-containing composition comprises no more than 1 wt. % of compound having metal directly bound to halogen; and

(iii) the desalting removes at least a portion of the hydrocarbon feed's halogen-containing composition to produce a desalted feed comprising at least a portion of the hydrocarbon feed's hydrocarbon and at least a portion of the hydrocarbon feed's metal-containing composition;

separating a pyrolysis feed and a second stream from the desalted feed, wherein

(i) the pyrolysis feed comprises at least a portion of the desalted feed's hydrocarbon and a first portion of the of the desalted feed's metal-containing composition, and

(ii) the second stream comprises least a second portion of the desalted feed's metal-containing composition;

pyrolysing the pyrolysis feed to produce a pyrolysis effluent comprising one or more metal-containing compositions that are derived from at least a portion of the pyrolysis feed's metal-containing composition; and

separating from the pyrolysis effluent a bottoms stream and an upgraded pyrolysis effluent, wherein

(i) the upgraded pyrolysis effluent comprises light olefin, and

(ii) the bottoms stream comprises at least a portion of the pyrolysis effluent's metal-containing composition.

2. The process of claim 1, comprising (i) preheating the desalted feed before combining the desalted feed with steam, (ii) combining the preheated hydrocarbon feed with steam before separating the pyrolysis feed and the second stream from the combined preheated feed and steam, and the pyrolysis includes steam cracking; and wherein (a) hydrocarbon feed comprises at least one heavy hydrocarbon, (b) the preheated feed has a halogen concentration CH_1, the hydrocarbon feed has a halogen concentration CH_2, and the mass ratio of CH_1 to CH_2 is in the

range of from 0.01 : 1 to 0.5 : 1, (c) the combined preheated hydrocarbon and steam is a steam cracking feed, (d) the pyrolysis effluent is a steam cracker effluent, and (e) the upgraded pyrolysis effluent is an upgraded steam cracker effluent.

3. The process of claims 1 or 2, wherein (i) the hydrocarbon feed comprises heavy crude oil, and (ii) the desalting transfers to the brine ≥ 25 wt. % of the hydrocarbon feed's halogen-containing composition, and ≥ 75 wt. % of the hydrocarbon feed's hydrocarbon resides in the desalted feed.

4. The process of any of claims 1-3, wherein the desalted feed has a asphaltene concentration CA_1, and the hydrocarbon feed has a asphaltene concentration CA_2, and the mass ratio of CA_1 to CA_2 is in the range of from 0.9:1 to 1:1, and wherein the desalting removes ≥ 25 wt. % of any particulates contained in the hydrocarbon feed.

5. The process of any of claims 1-4, wherein the pyrolysis feed comprises (i) about 5 wppm or less of nickel-containing compounds, and/or (ii) about 5 wppm or less of vanadium-containing compounds.

6. The process of any of claims 1 to 5, further comprising fractionating and/or quenching the upgrading pyrolysis effluent to separate therefrom at least a naphtha and a process gas.

7. The process of any of claims 1 to 6, wherein the separation of the pyrolysis feed and the second stream from the steam cracking feed is carried out at a pressure of about 500 kPa (abs) or greater.

8. The process of any of claims 1 to 7, wherein the pyrolysis includes heating the pyrolysis feed to a temperature of about 760°C or greater.

9. The process of any of claims 2 to 8, wherein the pyrolysis is carried out at in at least one radiant coil located in a radiant section of a steam cracking furnace, the radiant coil having an inlet for introducing the pyrolysis feed and an outlet for removing the steam cracker effluent, and wherein the pyrolysis conditions include a pressure at the radiant coil outlet of about 50

kPa (abs) or greater and a residence time in the radiant coil in the range of from about 0.1 second to about 2 seconds.

10. The process of any of claims 2 to 9, further comprising (i) cooling the steam cracker effluent in one or more transfer line heat exchangers before the separation of the bottoms stream and/or (ii) quenching the steam cracker effluent with a first substantially liquid-phase quench stream.

11. The process of any of claims 2-10, wherein the separation of the bottoms stream and upgraded steam cracker effluent is carried out in at least one tar knock-out drum, and further comprising quenching the steam cracker effluent in the tar knock-out drum with a second substantially liquid-phase quench stream to achieve a temperature of the bottoms stream of about 350°C or less.

12. The process of claim 11, wherein the first and/or second quench stream comprises quench oil and/or steam cracked gas oil.

13. The process of claim 11, further comprising accumulating the separated steam cracked tar in a lower region of the tar knock-out drum, and maintaining the separated steam cracked tar at a temperature of about 350°C or less.

14. The process of any of claims 1-13, wherein the bottoms stream comprises steam cracker tar, and further comprising (i) demetallizing the steam cracker tar and (ii) hydroprocessing at least a portion of the demettalized steam cracker tar in at least two hydroprocessing stages.

15. The process of claim 14, wherein the demetallizing includes one or more of centrifuging, sorption, and catalytic demetallization.

16. The process of claim 14, wherein (i) the hydroprocessed steam cracker tar has a concentration CV_1 of vanadium-containing compounds, the bottoms stream has a concentration CV_2 of vanadium-containing compounds, and the mass ratio of CV_1 to CV_2 is in the range of from 1:10 to 1:1000, and the hydroprocessed steam cracker tar has a concentration CN_1 of

nickel-containing compounds, the bottoms stream has a concentration CN_2 of nickel-containing compounds, and the mass ratio of CN_1 to CN_2 is in the range of from 1:10 to 1:1000.

17. A process for producing light olefin from a raw feed, the process comprising

desalting the raw feed, wherein

(i) the raw feed comprises hydrocarbon, chloride-containing compounds, nickel-containing compounds, vanadium-containing compounds, and wherein the nickel-containing compounds, vanadium-containing compounds are substantially-free of chloride,

(ii) the desalting transfers to a brine at least a portion of the raw feed's chloride-containing compounds to produce a desalted feed comprising at least a portion of the raw feed's hydrocarbon, at least a portion of the raw feed's nickel-containing compounds, and at least a portion of the raw feed's vanadium-containing compounds;

introducing the desalted feed into at least one convection coil within a steam cracking furnace to form a preheated feed;

combining the preheated feed with steam to produce a steam cracking feed;

introducing the steam cracking feed into a flash separator to separate from the steam cracking feed a bottoms stream and a pyrolysis feed, the pyrolysis feed having fewer nickel-containing compounds and fewer vanadium-containing compounds than does the steam cracking feed;

introducing the pyrolysis feed into at least one radiant coil within the steam cracking furnace to produce a steam cracker effluent;

separating in at least one tar knock-out drum an upgraded steam cracker effluent and a steam cracker tar from the steam cracker effluent; and

introducing the steam cracker tar into a clean fuels unit to produce a clean fuels product comprising hydroprocessed tar.

18. The process of claim 17, wherein the desalted feed has a chloride concentration CC_1, the hydrocarbon feed has a chloride concentration CC_2, and the mass ratio of CC_1 to CC_2 is in the range of from 0.01 : 1 to 0.5 : 1.

19. The process claims 17 or 18, wherein the flash separation includes transferring to the bottoms stream ≥ 95 wt. % of any nickel-containing compounds remaining after the desalting, ≥ 95 wt. % of any vanadium-containing compounds remaining after the desalting, and ≥ 95 wt. % of any asphaltenes remaining after the desalting.

20. The process of any of claims 17 to 19, wherein the pyrolysis feed comprises about 5 wppm or less of vanadium-containing compounds.

21. The process of any of claims 17-20, wherein the raw feed comprises one or more medium crude oil, one or more heavy crude oil, and mixtures thereof.

22. The process of any of claims 17-21, wherein (i) the clean fuels product has a concentration CV_1 of any vanadium-containing compounds, the steam cracker tar has a concentration CV_2 of any vanadium-containing compounds, and the mass ratio of CV_1 to CV_2 is in the range of from 1:10 to 1:1000 and/or (ii) the clean fuels product has a concentration CN_1 of nickel-containing compounds, the bottoms stream has a concentration CN_2 of nickel-containing compounds, and the mass ratio of CN_1 to CN_2 is in the range of from 1:10 to 1:1000.

23. An apparatus for managing contaminants in production of light olefins, the apparatus comprising:

a desalter in fluid connection with a convection coil within a steam cracking furnace, the convection coil being in fluid connection with a flash separator;

a radiant coil within a steam cracking furnace, the radiant coil having (i) an inlet fluid connection with the flash separator and (ii) an outlet in fluid connection with a tar knock-out drum inlet;

a tar knock-out drum that includes the inlet and an outlet, the outlet being in fluid connection with (i) an inlet of a clean fuels unit, and (ii) an inlet of a primary fractionator; and

a quench fluid conduit having (i) an inlet in fluid connection with an outlet of the primary fractionator and (ii) an outlet in fluid connection with the radiant coil outlet and/or in the tar knock-out drum.

24. A pyrolysis process, comprising:

(a) desalting a hydrocarbon feed, wherein

(i) the hydrocarbon feed comprises hydrocarbon, at least one halogen-containing composition, and at least one metal-containing composition,

(ii) the halogen-containing composition and the metal-containing composition are different, wherein the metal-containing composition comprises no more than 1 wt. % of compounds having metal directly bound to halogen; and

(iii) the desalting removes at least a portion of the hydrocarbon feed's halogen-containing composition to produce a desalted feed comprising at least a portion of the hydrocarbon feed's hydrocarbon and at least a portion of the hydrocarbon feed's metal-containing composition;

(b) preheating the desalted feed to form a preheated feed;

(c) combining steam and the preheated feed to produce a steam cracking feed comprising at least a portion of the hydrocarbon feed's hydrocarbon and at least a portion of the hydrocarbon feed's metal-containing composition;

(d) separating a pyrolysis feed and a second stream from the steam cracking feed, wherein

(i) the pyrolysis feed comprises at least a portion of the steam cracking feed's hydrocarbon and a first portion of the of the steam cracking feed's metal-containing composition, and

(ii) the separation transfers at least a second portion of the steam cracking feed's metal-containing composition to the second stream;

(e) pyrolysing the pyrolysis feed to produce a steam cracker effluent comprising one or more metal compositions that are derived from at least a portion of the pyrolysis feed's metal-containing composition; and

(f) separating a bottoms stream comprising separated steam cracker tar and an upgraded steam cracker effluent from the steam cracker effluent, wherein the upgraded steam cracker effluent comprises light olefin, and the separation transfers at least a portion of the steam cracker effluent's metal-containing compositions to bottoms stream.