**CLAIMS:**

1. A pyrolysis tar processing method, comprising:

mixing a tar feed with a utility fluid to produce a tar-fluid mixture, wherein the tar feed includes at least one tar, the utility fluid has a solubility blending number of 90 or more, a density of 0.98 g/cm$^3$ or less, and a bromine number of less than 5, and the utility fluid comprises 30 wt. % or more of compounds with a ring class of 1.5 and 20 wt. % or less of compounds with a ring class of 1.0 or less; and

hydroprocessing the tar-fluid mixture under solvent-assisted hydroprocessing conditions to form a hydroprocessed effluent, the hydroprocessed effluent comprising a mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less.

2. The method of claim 1, wherein the tar is a steam cracker tar, and the utility fluid comprises a density of 0.96 g/cm$^3$ or less.

3. The method of claim 1, wherein the utility fluid comprises 25 wt. % or less of compounds having a ring class of 2.5 or more.

4. The method of claim 1, wherein the utility fluid comprises a solubility blending number of 110 or more.

5. The method of claim 1, wherein the utility fluid comprises 5.0 wt. % or less of aliphatic compounds.

6. The method of claim 1, wherein the tar-fluid mixture comprises 40 wt. % to 90 wt. % pyrolysis tar and 10 wt. % to 60 wt. % utility fluid, relative to a weight of the tar-fluid mixture.

7. The method of claim 1, wherein the tar-fluid mixture has a tar feed to utility fluid weight ratio of 1.0 or more.

8. The method of claim 1, further comprising:

separating a recycle fraction comprising the mid-cut fraction from the hydroprocessed effluent;

mixing the recycle fraction with a second portion of the tar feed; and

hydroprocessing the mixture of the second portion of the tar feed and the recycle fraction under the solvent-assisted hydroprocessing conditions to form a second hydroprocessed effluent, the second hydroprocessed effluent comprising a second mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less.

9. The method of claim 8, wherein a density of the recycle fraction is greater than the density of the utility fluid.

10. The method of claim 8, wherein the recycle fraction comprises 30 wt. % or less of compounds having a ring class of 1.5.

11. The method of claim 8, wherein the recycle fraction comprises a solubility blending number of 110 or more.

12. The method of claim 8, wherein the recycle fraction comprises 5.0 wt. % or less of aliphatic compounds.

13. The method of claim 8, wherein the mixture of the second portion of the tar feed and the recycle fraction comprises 40 wt. % to 90 wt. % of SCT tar and 10 wt. % to 60 wt. % of the second recycle fraction, relative to a weight of the mixture.

14. The method of claim 8, wherein the mixture of the second portion feedstock and the recycle fraction comprises a weight ratio of pyrolysis tar to second recycle fraction of 1.0 or more.

15. The method of claim 1, wherein the utility fluid comprises a bottoms fraction from a catalytic reforming process.

16. A hydroprocessing method, comprising:

mixing a pyrolysis tar feed with a utility fluid to produce a tar-fluid mixture, wherein the utility fluid has a solubility blending number of 90 or more, a density of 0.98 g/cm$^3$ or less, and a bromine number of less than 5, and the utility fluid comprises 30 wt. % or more of

compounds with a ring class of 1.5, 20 wt. % or less of compounds with a ring class of 1.0 or less, and 5.0 wt. % or less of aliphatic compounds;

hydroprocessing the tar-fluid mixture under solvent-assisted hydroprocessing conditions to form a hydroprocessed effluent, the hydroprocessed effluent comprising a mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less;

separating a recycle fraction comprising the mid-cut fraction from the hydroprocessed effluent to form, the recycle fraction having a density greater than that of the utility fluid;

mixing the recycle fraction with a second portion of feedstock; and

hydroprocessing the mixture of the second portion of feedstock and the recycle fraction under the solvent-assisted hydroprocessing conditions to form a second hydroprocessed effluent, the second hydroprocessed effluent comprising a second mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less.

17. The method of claim 16, wherein the recycle fraction comprises 30 wt. % or less of compounds having a ring class of 1.5.

18. The method of claim 16, wherein the recycle fraction comprises a solubility blending number of 110 or more.

19. The method of claim 16, wherein the recycle fraction comprises 5.0 wt. % or less of aliphatic compounds.

20. The method of claim 16, wherein the mixture of the second portion of feedstock and the recycle fraction comprises 40 wt. % to 90 wt. % pyrolysis tar and 10 wt. % to 60 wt. % of the second recycle fraction, relative to a weight of the mixture.

21. The method of claim 16, wherein the mixture of the second portion feedstock and the recycle fraction comprises a weight ratio of pyrolysis tar to second recycle fraction of 1.0 or more.

22. The method of claim 16, wherein the utility fluid comprises 25 wt. % or less of compounds having a ring class of 2.5 or more.

23. The method of claim 16, wherein the formation of the recycle fraction and the mixing of the recycle fraction with the second portion of feedstock is repeated at least two times.

24. The method of claim 16, wherein the formation of the recycle fraction and the mixing of the recycle fraction with the second portion of feedstock is repeated continuously or semi-continuously.

25. A hydrocarbon upgrading process, comprising

(a) providing a naphtha feed

(b) reforming the naphtha to produce a reformate

(c) separating an aromatics bottoms stream from the reformate, wherein (i) the aromatics bottoms stream comprising ≥ 30 wt. % of compounds with a ring class of 1.5 and ≤ 20 wt. % of compounds with a ring class of 1.0, based on the weight of the aromatics bottoms stream, and (ii) the aromatics bottoms stream has a $S_{BN} \geq 90$, a density ≤ 0.98 g/cm$^3$, and a bromine number < 5;

(d) combining the aromatics bottoms stream and a tar feed to produce a tar-fluid mixture;

(e) catalytically hydroprocessing the tar-fluid mixture to form a hydroprocessed effluent, the hydroprocessed effluent comprising a mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less;

(f) separating a recycle fraction comprising the mid-cut fraction from the hydroprocessed effluent to form, the recycle fraction having a density greater than that of the aromatics bottoms stream;

(g) substituting the recycle fraction for at least a portion of the aromatics bottoms stream in step (c) to produce a second tar-fluid mixture; and

(h) catalytically hydroprocessing the second tar-fluid mixture to form a second hydroprocessed effluent, the second hydroprocessed effluent comprising a second mid-cut fraction having a solubility blending number of 90 or more, an initial boiling point of 150°C or more, and a final boiling point of 400°C or less.

26. The process of claim 25, wherein the aromatics bottoms stream is a primer fluid.