CLAIMS;

What is claimed is:

1. A process for producing mesophase pitch, the process comprising:

providing a feedstock having a T5 ≥ 400°F (204°C) and a T95 ≤ 1,400°F (760°C);

configuring conditions for a heat treatment of the feedstock that satisfy a relationship [X*Y] ≥ 20,000 seconds, wherein X is the equivalent reaction time (ERT) of the heat treatment, and wherein Y is the bromine number of the feedstock as measured in accordance with ASTM D1159;

heating the feedstock at the conditions, wherein the conditions comprise a temperature ranging from 420°C to 520°C to produce a heat treated product including isotropic pitch;

contacting the isotropic pitch with a solvent having a Solubility Blending number (S_{BN}) of at least 10 SU under conditions sufficient to produce a solvent fraction comprising the solvent and an insoluble fraction comprising mesophase pitch; and

recovering the mesophase pitch.

2. The process of claim 1, wherein the feedstock has a bromine number ≥ 10, and wherein the heating is conducted at an ERT of at least 2,000 seconds.

3. The process of claim 1, wherein the feedstock has a bromine number < 10, and wherein the heating is conducted at ERT of at least 4,000 seconds.

4. The process of claim 1, wherein the heating is conducted a temperature ranging from 420°C to 510°C.

5. The process of claim 1, wherein the feedstock comprises a fraction having a boiling point of ≥ 1,050°F (566°C) ranging from 1 wt% to 40 wt% based on the weight of the feedstock.

6. The process of claim 1, wherein the feedstock comprises at least one member selected from the group consisting of main column bottoms (MCB), hydroprocessed MCB, steam cracker tar, hydrotreated steam cracker tar, vacuum resid, deasphalted residue or rock, and mixtures or combinations thereof.

7. The process of claim 1, wherein the isotropic pitch has at least one of the following properties:

(a) a micro carbon residue (MCR) as measured in accordance with ASTM D4530-15 ranging from 30% to 90%;

(b) a softening point as measured in accordance with ASTM D3104-14 ranging from 80°C to 250°C;

(c) a mesophase pitch content as measured in accordance with ASTM D4616-95(2018) of greater than 0.5 vol%; and

(d) a quinoline insoluble content as measured in accordance with ASTM D2318-15 of greater than 1 wt%.

8. The process of claim 7, wherein the isotropic pitch has a micro carbon residue (MCR) as measured in accordance with ASTM D4530-15 of at least 60%.

9. The process of claim 1, further comprising separating the heat treated product to produce a heavy fraction comprising the isotropic pitch and a light fraction.

10. The process of claim 1, wherein the insoluble fraction comprises a residual amount of the solvent, and wherein recovering the mesophase pitch comprises removing at least a portion of the residual solvent to form a recovered solid product, and wherein the yield of the recovered solid product is at least 10 wt%, and wherein the recovered solid product comprises at least 30 vol% of an optically active fraction.

11. The process of claim 1, wherein the ratio of the isotropic pitch to the solvent during the contacting ranges from 10:1 to 1:1 by volume.

12. The process of claim 1, wherein the solvent has an S_{BN} ranging from 10 SU to 130 SU.

13. The process of claim 1, wherein the solvent has an S_{BN} ranging from 10 SU to 100 SU.

14. The process of claim 1, wherein the solvent is selected from the group consisting of single-ring aromatics, two-ring aromatics, paraffins, a midcut solvent, and mixtures or combinations thereof, and wherein the solvent comprises from 10 to 100 vol% single ring aromatics and from 0 to 90 vol% n-heptane based on the volume of the solvent.

15. The process of claim 1, wherein the contacting is carried out at a temperature ranging from 90°C to 350°C.

16. The process of claim 1, wherein the contacting is carried out at a temperature ranging from 150°C to 350°C, a pressure ranging from 15 psig to 800 psig, and a residence time from 5 minutes to 5 hours.

17. The process of claim 1, further comprising separating the solvent phase to form a recovered solvent stream and a deasphalted oil stream.

18. The process of claim 17, further comprising recycling at least a portion of the recovered solvent stream to the solvent extraction, and further comprising recycling at least a portion of the deasphalted oil stream to the heat treating.

19. A carbon fiber produced from the mesophase pitch of claim 1.

20. A process for producing mesophase pitch, the process comprising:

providing a feedstock comprising at least one member selected from the group consisting of main column bottoms (MCB), hydroprocessed MCB, steam cracker tar, hydrotreated steam cracker tar, vacuum resid, deasphalted residue or rock, and mixtures or combinations thereof;

configuring conditions for a heat treatment of the feedstock that satisfy a relationship $[X*Y] \geq 20{,}000$ seconds, wherein X is the equivalent reaction time (ERT) of the heat treatment, and wherein Y is the bromine number of the feedstock as measured in accordance with ASTM D1159;

heating the feedstock at the conditions, wherein the conditions comprise a temperature ranging from 420°C to 520°C to produce a heat treated product including isotropic pitch;

contacting the isotropic pitch with a solvent selected from the group consisting of single-ring aromatics, two-ring aromatics, paraffins, a midcut solvent, and mixtures or combinations thereof under conditions sufficient to produce a solvent fraction comprising the solvent and an insoluble fraction comprising mesophase pitch; and

recovering the mesophase pitch.