

THAT WHICH IS CLAIMED IS:

1. An invention not claimed in any divisional application.

1. ~~A process for producing a base oil composition, comprising:~~

(a) ~~providing a deasphalted oil (DAO) feed;~~

(b) ~~hydrotreating a portion of the DAO feed in the presence of hydrotreating catalysts to produce a hydrotreated product;~~

(c) ~~hydrocracking the hydrotreated product in the presence of hydrocracking catalysts to produce a hydrocracked product;~~

(d) ~~fractionating the hydrocracked product wherein at least one fraction comprises hydrowax;~~

(e) ~~catalytically dewaxing the hydrowax in the presence of noble metal-based catalysts to produce a dewaxed product;~~

(f) ~~hydrofinishing the dewaxed product in the presence of hydrofinishing catalysts to produce a hydrofinished product;~~

(g) ~~fractionating the hydrofinished product wherein at least one fraction comprises the base oil composition; and~~

~~wherein the base oil composition is a hazy-free at 0°C heavy base oil comprising: (a) a kinetic viscosity ranging from 15 to 21 cSt at 100°C, (b) a viscosity index of at least 95, (c) a pour point of less than -12°C, (d) a cloud point of less than -18°C, and (e) a total aromatics content of 2 wt% or less;~~

~~wherein the hazy-free at 0°C heavy base oil maintains a hazy-free appearance when stored undisturbed at 0°C during a test period; and~~

~~wherein the hazy-free at 0°C heavy base oil composition is a Group II/III base oil.~~

2. ~~The process of claim 1, wherein the base oil composition is a hazy-free at 0°C heavy base oil comprising: (a) a kinetic viscosity ranging from 19 to 20 cSt at 100°C, (b) a viscosity index ranging from 100 to 119 for the Group II base oil and at least 120 for the Group III base oil, (c) a pour point of less than -24°C, (d) a cloud point of less than -21°C, and (e) a total aromatics content of 1 wt% or less; and~~

~~—wherein the hazy-free at 0°C heavy base oil maintains a hazy-free appearance when stored undisturbed at 0°C during a test period.~~

3. ~~The process of any one of claims 1 to 2, wherein the base oil composition comprises a sulfur content below 5 ppm and a nitrogen content below 5 ppm.~~

4. ~~The process of any one of claims 1 to 2, wherein the base oil composition comprises a sulfur content below 1 ppm and a nitrogen content below 1 ppm.~~

5. ~~The process of any one of claims 1 to 2, wherein the base oil composition comprises a saturates content ranging from about 98 wt% to about 99.9%.~~

6. ~~The process of any one of claims 1 to 2, wherein the test period is at least 5 hours.~~

7. ~~The process of any one of claims 1 to 2, wherein the test period is at least 7 hours.~~

8. ~~The process of claim 1, wherein the DAO feed comprises at least 50% by weight of hydrocarbons boiling above 450°C, at least 400 ppm of nitrogen, at least 0.5 wt% of sulfur, and a (nickel (Ni) + vanadium (V)) metal content ranging from 2-250 ppm.~~

9. ~~The process of claim 1, wherein the DAO feed comprises more than 65% by weight of hydrocarbons boiling above 450°C.~~

10. The process of any one of claims 8 to 9, wherein the DAO feed comprises at least one of a pure DAO or a blend of DAO and vacuum gas oil (VGO) and wherein the blend of DAO and VGO comprises a ratio of about 6:1 to about 1:6.
- 5 11. The process of any one of claims 8 to 9, wherein the DAO feed comprises a blend of DAO, VGO, and part of the hydrowax, in any combination thereof.
12. The process of any one of claims 1 to 11, wherein the hydrotreated product comprises nitrogen ranging from 0.1-30 ppm, sulfur ranging from 10-200 ppm, and a total uptake of at least 30% of the (Ni + V) metal content.
- 10 13. The process of any one of claims 1 to 12, wherein the hydrocracking catalysts at step (c) comprise a zeolite component.
- 15 14. The process of any one of claims 1 to 13, wherein the hydrocracking catalysts at step (c) comprise an additional zeolite component selected from zeolite beta, zeolite ZSM-5, or zeolite Y.
15. The process of any one of claims 1 to 14, further comprising a bed of hydrotreating catalysts at step (c) to produce the hydrocracked product.
- 20 16. The process of any one of claims 1 to 15, wherein the hydrocracking conditions of step (c) comprise a temperature in the range of from 250-500°C, a pressure in the range of from 35-250 bar, a weighted average bed temperature (WABT) in the range of from 350-420°C, a gas to oil ratio in the range of from 500-1500 NI/kg, and a weight hourly space velocity in the range of from 0.2-10 hr⁻¹.
- 25 17. The process of any one of claims 1 to 16, wherein the hydrowax at step (d) comprises a kinetic viscosity of at least 4.0 cSt at 100°C, a viscosity index of at least 120, a nitrogen content below 20 ppm, and a sulfur content below 100 ppm.
- 30 18. The process of any one of claims 1 to 17, further comprising stripping residual products from the hydrocracked product at step (d), wherein the residual products comprise at least one of ammonia (NH₃), hydrogen sulfide (H₂S), methane (CH₄), ethane (C₂H₆), liquefied petroleum gas (LPG), naphtha, and gas oil.
- 35 19. The process of any one of claims 1 to 18, wherein the noble metal based catalysts of step (e) comprise a graduated mixture comprising ZSM-12 and modified ZSM-12 zeolite based catalysts and EU-2 and/or ZSM-48 zeolite based catalysts.
- 40 20. The process of any one of claims 1 to 19, wherein the noble metal based catalysts of step (e) comprise the graduated mixture and noble metal aromatics hydrogenation catalysts.
21. The process of any one of claims 1 to 20, wherein the catalytically dewaxing conditions of step (e) comprise a temperature in the range of from 200-500°C, a pressure in the range of from 10-200 bar, a weighted average bed temperature (WABT) in the range of from 320-370°C, a gas to oil ratio in the range of from 500-1500 NI/kg, and a weight hourly space velocity (WHSC) in the range of from 0.2-10 hr⁻¹.
- 45 22. The process of any one of claims 1 to 21, wherein the hydrofinishing conditions of step (f) comprise a temperature in the range of from 125-390°C, a pressure in the range of from 70-200 bar, a weighted average bed temperature (WABT) in the range of from 220-270°C, a gas to oil ratio in the range of from 500-1500 NI/kg, and a weight hourly space velocity (WHSC) in the range of from 0.3-3.0 hr⁻¹.
- 50 23. The process of any one of claims 1 to 22, wherein at least one of the hydrofinishing catalysts of step (f) is a noble metal aromatics hydrogenation catalyst.
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24. A base oil composition, comprising:

(a) a kinetic viscosity ranging from 15 to 21 cSt at 100°C;

(b) a viscosity index of at least 95;

(c) a pour point of less than -12°C;

(d) a cloud point of less than -18°C;

(e) a total aromatics content of 2 wt% or less; and

wherein the base oil composition is a hazy-free at 0°C heavy base oil that maintains a hazy-free appearance when stored undisturbed at 0°C during a test period; and

wherein the hazy-free at 0°C heavy base oil composition is a Group II/III base oil.

25. The base oil composition of claim 24, further comprising:

(a) a kinetic viscosity ranging from 19 to 20 cSt at 100°C;

(b) a viscosity index ranging from 100 to 119 for the Group II base oil and at least 120 for the Group III base oil;

(c) a pour point of less than -24°C;

(d) a cloud point of less than -21°C;

(e) a total aromatics content of 1 wt% or less.

wherein the base oil composition is a hazy-free at 0°C heavy base oil that maintains a hazy-free appearance when stored undisturbed at 0°C during a test period.

26. The base oil composition of any of claims 24 to 25, wherein the test period is at least 5 hours.

27. The base oil composition of any of claims 24 to 25, wherein the test period is at least 7 hours.

28. The base oil composition of any of claims 24 to 27, further comprising a sulfur content below 5 ppm and a nitrogen content below 5 ppm.

29. The base oil composition of any of claims 24 to 27, further comprising a sulfur content below 1 ppm and a nitrogen content below 1 ppm.

30. The base oil composition of any of claims 24 to 29, further comprising a saturates content ranging from about 98 wt% to about 99.9%.

31. The base oil composition of any of claims 24 to 30, wherein the total aromatics content comprises a mono-aromatic content and a polycyclic aromatic content.