

CLAIMS:

~~1. A method for producing low sulfur distillate products, comprising:~~

~~hydrotreating a feedstock having a sulfur content of at least about 1500 wppm under effective hydrotreating conditions to produce at least a liquid fraction;~~

~~separating the liquid fraction from a gas phase fraction, the separated liquid fraction having a sulfur content of at least about 100 wppm;~~

~~hydroprocessing at least a portion of the separated liquid fraction under effective dewaxing conditions in the presence of a catalyst including at least one Group VIII metal on a bound zeolite, the bound zeolite comprising a one-dimensional 10-member ring zeolite; and fractionating the hydroprocessed liquid fraction to produce at least a product fraction, the product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.~~

2. A method for producing low sulfur distillate products, comprising:

hydrotreating a feedstock having a sulfur content of at least about 1500 wppm under effective hydrotreating conditions,

fractionating the hydrotreated feedstock in a first volume of a divided wall column fractionator to produce at least a liquid fraction and a first common fraction that is passed to an upper undivided volume of the fractionator, the liquid fraction having a sulfur content from about 200 wppm to about 500 wppm;

hydroprocessing at least a portion of the liquid fraction under effective dewaxing conditions in the presence of a catalyst including at least one Group VIII metal on a bound zeolite, the bound zeolite comprising a one-dimensional 10-member ring zeolite; and

fractionating the hydroprocessed liquid fraction in a second volume of the divided wall column fractionator to produce at least a product fraction and a second common fraction that is passed to the upper undivided volume of the fractionator, the product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.

- ~~3. The method of claim 2, wherein the height of the dividing wall is selected so that the second product fraction contains about 1 wt% or less of material corresponding to the first product fraction.~~
4. The method of any one of the previous claims, wherein the sulfur content of the separated liquid fraction is about 500 wppm or less, and wherein the at least one Group VIII metal on the bound zeolite comprises Pt and/or Pd.
5. The method of claim 4, wherein the Group VIII metal is Pt, and the amount of Group VIII metal on the bound zeolite is from about 0.1 wt% to about 1.5 wt%.
6. A method for producing low sulfur distillate products, comprising:
 - hydrotreating a feedstock having a sulfur content of at least about 1500 wppm under effective hydrotreating conditions to produce at least a liquid fraction;
 - hydroprocessing at least a portion of the liquid fraction, the at least a portion of the liquid fraction having a sulfur content of at least about 100 wppm, under effective dewaxing conditions in the presence of a catalyst including at least one Group VIII metal on a bound zeolite, the bound zeolite comprising a one-dimensional 10-member ring zeolite, the at least one Group VIII metal comprising Ni; and
 - fractionating the hydroprocessed liquid fraction to produce at least a product fraction, the product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.
7. A method according to claim 6, wherein the dewaxing catalyst further comprises a Group VI metal, the Group VI metal being W, Mo, or a combination thereof.
8. A method according to claim 7, wherein the amount of Ni is from about 1 wt% to about 5 wt%, and the amount of Group VI metal is from about 5 wt% to about 20 wt%.
9. A method according to any one of claims 6-8, wherein the at least a portion of the liquid fraction is cascaded from the hydrotreating to the hydroprocessing without intermediate separation.

~~10. The method of any one of the previous claims, wherein the effective hydrotreating conditions comprise a pressure from about 300 psig (about 2.1 MPag) to about 800 psig (about 5.5 MPag), a temperature from about 500°F (about 260°C) to about 800°F (about 427°C), and a space velocity from about 0.3 hr⁻¹ to about 5.0 hr⁻¹.~~

11. The method of any one of the previous claims, wherein the effective hydrotreating conditions include a treat gas rate that provides an amount of hydrogen from about two times to about five times the hydrogen consumed during the hydrotreating.

12. The method of any one of the previous claims, wherein the effective dewaxing conditions include a temperature from about 280°C to about 380°C, a pressure from about 300 psig (about 2.1 MPag) to about 800 psig (about 5.5 MPag), an LHSV from about 0.5 hr⁻¹ to about 5.0 hr⁻¹, and a hydrogen treat gas rate of from about two times to about fifteen times the hydrogen consumed during the dewaxing.

CLAIMS:

1. A method for producing low sulfur distillate products, comprising:

hydrotreating a feedstock having a boiling range from about 451°F to about 800°F, and a sulfur content of at least about 1500 wppm and including fractions in the 600°F+ boiling range containing sulfur species including alkyl-substituted dibenzothiophenes under hydrotreating conditions at a total pressure of 400 to 800 psig and a temperature from 500°F to about 800°F to produce a liquid effluent and a gas phase fraction;

separating the liquid effluent from contaminant hydrogen sulfide and ammonia gases formed during the hydrotreatment to form a liquid fraction having a sulfur content of at least about 200 wppm and a nitrogen content not more than 5 ppmw;

hydroprocessing at least a portion of the separated hydrotreated liquid fraction having a sulfur content of at least 200 wppm under dewaxing conditions at a total pressure of 300 to 800 psig and a temperature from 280°C to about 380°C in the presence of a catalyst having isomerization dewaxing activity and including at least one Group VIII noble metal on a bound zeolite, the bound zeolite comprising ZSM-48; and

fractionating the hydroprocessed liquid fraction to produce a product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.

2. The method of claim 1, wherein the hydrotreating conditions comprise a space velocity from about 0.3 hr⁻¹ to about 5.0 hr⁻¹.

3. The method of claim 1, wherein the effective hydrotreating conditions include a treat gas rate that provides an amount of hydrogen from about two times to about five times the hydrogen consumed during the hydrotreating.

4. The method of claim 1, wherein the dewaxing conditions include an LHSV from about 0.5 hr⁻¹ to about 5.0 hr⁻¹, and a hydrogen treat gas rate of from about two times to about fifteen times the hydrogen consumed during the dewaxing.

5. The method of claim 1, wherein the at least one Group VIII metal on the bound zeolite comprises Pt and/or Pd.

6. A method for producing low sulfur distillate products, comprising:

hydrotreating a feedstock having a boiling range from about 451°F to about 800°F, a sulfur content of at least about 1500 wppm and including fractions in the 600°F+ boiling range containing sulfur species including alkyl-substituted dibenzothiophenes under hydrotreating conditions at a total pressure of 400 to 800 psig and a temperature from 500°F to about 800°F;

separating liquid effluent of the hydrotreating step from contaminant hydrogen sulfide and ammonia gases formed during the hydrotreatment to form a hydrotreated feedstock;

fractionating the hydrotreated feedstock in a first volume of a divided wall column fractionator to produce a liquid fraction and a first common fraction that is passed to an upper undivided volume of the fractionator, the liquid fraction having a sulfur content from about 200 wppm to about 500 wppm and a nitrogen content of not more than 5 ppmw;

hydroprocessing a portion of the liquid fraction having a sulfur content from about 200 wppm to about 500 wppm and a nitrogen content not more than 5 ppmw under dewaxing conditions at a total pressure of 300 to 800 psig and a temperature from 280°C to about 380°C in the presence of a catalyst having isomerization dewaxing activity and including at least one Group VIII noble metal on a bound zeolite, the bound zeolite comprising ZSM-48; and

fractionating the hydroprocessed liquid fraction in a second volume of the divided wall column fractionator to produce at least a product fraction and a second common fraction that is passed to the upper undivided volume of the fractionator, the product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.

7. The method of claim 6, wherein the hydrotreating conditions include a treat gas rate that provides an amount of hydrogen from about two times to about five times the hydrogen consumed during the hydrotreating.

8. The method of claim 6, wherein the hydrotreating conditions comprise a pressure from about 300 psig to about 800 psig a temperature from about 500°F to about 800°F, and a space velocity from about 0.3 hr⁻¹ to about 5.0 hr⁻¹.
9. The method of claim 6, wherein the dewaxing conditions include a temperature from about 280°C to about 380°C, a pressure from about 300 psig to about 800 psig an LHSV from about 0.5 hr⁻¹ to about 5.0 hr⁻¹, and a hydrogen treat gas rate of from about two times to about fifteen times the hydrogen consumed during the dewaxing.
10. The method of claim 6, wherein the height of the dividing wall is selected so that the product fraction contains about 1 wt% or less of material corresponding to the liquid fraction.
11. The method of claim 6, wherein the Group VIII metal on the bound zeolite is Pt, Pd, or a combination thereof.
12. The method of claim 6, wherein the Group VIII metal is Pt, and the amount of Group VIII metal on the bound zeolite is from about 0.1 wt% to about 1.5 wt%.
13. The method of claim 6, further comprising hydrofinishing the dewaxed liquid fraction under effective hydrofinishing conditions prior to fractionating the dewaxed liquid fraction, the effective hydrofinishing conditions including a temperature from about 180°C to about 280°C, a total pressure from about 300 psig to about 800 psig, an LHSV from about 0.1 hr⁻¹ to about 5 hr⁻¹, and a hydrogen treat gas rate of from about two times to about five times the hydrogen consumed during the hydrofinishing.
14. A method for producing low sulfur distillate products, comprising:
hydrotreating a feedstock having a boiling range from about 451°F to about 800°F, and a sulfur content of at least about 1500 wppm and including fractions in the 600°F+ boiling range containing sulfur species including alkyl-substituted dibenzothiophenes under hydrotreating conditions to produce a hydrotreated effluent

comprising a liquid fraction and a gaseous fraction comprising contaminant hydrogen sulfide and ammonia;

separating the liquid fraction from the contaminant hydrogen sulfide and ammonia to produce a liquid fraction having a sulfur content of about 200 to 500 wppm and a nitrogen content not more than 5 ppmw;

hydroprocessing at least a portion of the liquid fraction under dewaxing conditions at a total pressure of 300 to 800 psig and a temperature from 280°C to about 380°C in the presence of a catalyst having isomerization dewaxing activity Pt on ZSM-48; and

fractionating the hydroprocessed liquid fraction to produce a product fraction, the product fraction having a sulfur content of about 15 wppm or less, a nitrogen content of about 5 wppm or less, and a cloud point of about -15°C or less.

15. The method of claim 14, wherein the hydrotreating conditions include a treat gas rate that provides an amount of hydrogen from about two times to about five times the hydrogen consumed during the hydrotreating.

16. The method of claim 14, wherein the hydrotreating conditions comprise a space velocity from about 0.3 hr⁻¹ to about 5.0 hr⁻¹.

17. The method of claim 14, wherein the effective dewaxing conditions include an LHSV from about 0.5 hr⁻¹ to about 5.0 hr⁻¹, and a hydrogen treat gas rate of from about two times to about fifteen times the hydrogen consumed during the dewaxing.