Summary

In one aspect of the present disclosure, there is provided a process for production of a hydrocarbon fraction suitable for use as jet fuel (80, 224) from an oxygenate feedstock (2, 202), comprising the steps of

a. combining the feedstock (2, 202) with a diluent hydrocarbon stream (6, 226) to form a hydrotreatment feed stream (4, 204) to contact a material catalyti-cally active in hydrotreatment (10a, 10b, 10c, 10d, HDO) comprising one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising an amorphous refractory oxides, under hydrotreating conditions to provide a hydrotreated intermediate product (14, 206),

b. directing said hydrotreated intermediate product (14, 206) to contact a material catalytically active in hydrocracking (18a, 18b, HDC) comprising one or more sulfided base metals such as nickel, cobalt, tungsten and/or molybdenum, an acidic support and a refractory support, under hydrocracking conditions to provide a hydrocracked in-termedi-ate product (22, 212),

c. separating the hydrocracked intermediate product (22, 212) in a hy-drocracked intermediate liquid fraction (34, 226) and a gaseous fraction (26, 220),

d. directing at least an amount of said hydrocracked intermediate liquid fraction (34, 226) to contact a material catalytically active in hydrodearomatization (90a, 90b, HDA) comprising an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble met-als such as platinum or palladium and a refractory support, preferably amorphous sil-ica-alumina, alumina, silica or titania, or combinations thereof, under hydrodearomati-zation conditions sufficient to provide a treated product (92, 218) comprising less than 1 wt/wt%, aromatics, calculated by total mass of aromatic molecules relative to all hy-drocarbons in the stream and comprising the hydrocarbon fraction suitable for use as jet fuel (106, 218).

In another aspect of the present disclosure, there is provided a process plant for pro-duction of a hydrocarbon suitable for use as a jet fuel (106, 218) from a feedstock (2, 202) being a renewable feedstock or an oxygenate feed-stock, comprising a hy-drotreatment section (8, HDO) containing a material catalytically active in hydrodeoxy-genation comprising one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising an amorphous refractory

oxides, a hydrocracking section (16) containing a material catalytically active in hydrocracking, comprising one or more sulfided base metals such as nickel, cobalt, tungsten and/or molybdenum, an acidic support and a refractory support and a hydrodearomatization section (86) containing a material catalytically active in hydrodearomatization comprising an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium and a refractory support, preferably amorphous silica-alumina, alumina, silica or titania, or combinations thereof, said process plant being configured for

a. directing the feedstock (2, 2a, 2b, 2c, 2d, 202) to the hydrotreatment section (8, HDO) to provide a hydrotreated intermediate product (14, 206),

b. directing the hydrotreated intermediate product (14, 206) to the hydrocracking section (16, HDC) to provide a hydrocracked in-termediate product (22 212),

c. directing at least an amount of said hydrocracked intermediate product (22, 212) to a hydrodearomatization section (86, HDA) to provide a treated prod-uct (92) comprising the hydrocarbon fraction suitable for use as a jet fuel (106, 218) wherein said treated product (92, 218) comprises less than 1 wt/wt% aromatics, calculated by total mass of aromatic molecules relative to all hydrocarbons in the stream.

Claims:

1. A process for production of a hydrocarbon fraction suitable for use as jet fuel (80, 224) from an oxygenate feedstock (2, 202), comprising the steps of
    a. combining the feedstock (2, 202) with a diluent hydrocarbon stream (6, 226) to form a hydrotreatment feed stream (4, 204) to contact a material catalytically active in hydrotreatment (10a, 10b, 10c, 10d, HDO) comprising one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising an amorphous refractory oxides, under hydrotreating conditions to provide a hydrotreated intermediate product (14, 206),
    b. directing said hydrotreated intermediate product (14, 206) to contact a material catalytically active in hydrocracking (18a, 18b, HDC) comprising one or more sulfided base metals such as nickel, cobalt, tungsten and/or molybdenum, an acidic support and a refractory support, under hydrocracking conditions to provide a hydrocracked intermediate product (22, 212),
    c. separating the hydrocracked intermediate product (22, 212) in a hydrocracked intermediate liquid fraction (34, 226) and a gaseous fraction (26, 220),
    d. directing at least an amount of said hydrocracked intermediate liquid fraction (34, 226) to contact a material catalytically active in hydrodearomatization (90a, 90b, HDA) comprising an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium and a refractory support, preferably amorphous silica-alumina, alumina, silica or titania, or combinations thereof, under hydrodearomatization conditions sufficient to provide a treated product (92, 218) comprising less than 1 wt/wt%, aromatics, calculated by total mass of aromatic molecules relative to all hydrocarbons in the stream and comprising the hydrocarbon fraction suitable for use as jet fuel (106, 218).

2. The process according to claim 1, wherein an amount of said hydrocracked intermediate liquid fraction (34, 226) is directed as said diluent hydrocarbon stream (6, 226).

3. The process according to claim 1 or 2 wherein step c comprises separating the hydrocracked intermediate product (22, 212) according to boiling point, providing a hydrocracked intermediate jet product (80, 224) having T10 above 205°C and final boiling point below 310°C according to ASTM D86.

4. The process according to claim 1, 2 or 3 wherein step b or d further comprises directing a stream for isomerization being either said hydrotreated intermediate product (14, 206), said hydrocracked intermediate product (22, 212) or said treated product (92) to contact a material catalytically active in isomerization (20, 88, ISOM) under isomerization conditions, to provide an isomerized stream being used in step b or d as said hydrotreated intermediate product (14, 206), said hydrocracked intermediate product (22, 212) or said treated product (92) respectively.

5. The process according to claim 1, 2, 3 or 4 wherein an amount of the hydrocracked intermediate product (22, 212) optionally after separation according to boiling point, and at least comprising a hydrocarbon fraction boiling above 310°C, is directed to be combined with either said feedstock (2, 202) or said hydrotreated intermediate product (14, 216).

6. The process according to claim 1, 2, 3, 4 or 5 wherein step b comprises separating the hydrotreated intermediate product (14, 206) in a liquid hydrotreated intermediate product and a gaseous fraction, and optionally the further step of separating the liquid hydrotreated intermediate product according to boiling point, providing a hydrotreated intermediate jet product having T10 above 120°C and final boiling point below 310°C according to ASTM D86.

7. The process according to claim 1, 2, 3, 4, 5 or 6 wherein the process conditions are selected such that the conversion, defined as the difference in the amount of material boiling above 310ºC in said hydrocracked intermediate product (22, 212) and the amount of material boiling above 310ºC in said hydrotreated intermediate product (14, 206), relative to the amount of material boiling above 310ºC in said hydrotreated intermediate product (14, 206), is above 20%, 50% or 80%.

8. The process according to claim 1, 2, 3, 4, 5, 6, or 7 wherein said treated product (92, 218) comprises less than 0.5 wt/wt% or 0.1 wt/wt% aromatics, calculated by total mass of aromatic molecules relative to all hydrocarbons in the stream.

9. The process according to claim 1, 2, 3, 4, 5, 6, 7, or 8 wherein a hydrogen rich stream (84) comprising at least 90 vol/vol% hydrogen is directed to contact the material catalytically active in hydrodearomatization, and wherein an amount of said gaseous fraction (26) is optionally purified and directed to contact the material catalytically active in hydrotreatment (10a, 10b, 10c, 10d).

10. The process according to claim 1, 2, 3, 4, 5, 6, 7, 8 or 9 wherein the treated product (92) is directed to a gas/liquid separator (94) to provide a second stage gaseous fraction (96) and a treated intermediate jet product (98) which is directed to a further means of separation (100), such as a stripper, to provide said hydrocarbon fraction suitable for use as jet fuel (106) and a treated product off gas (108).

11. The process according to claim 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, wherein hydrotreatment conditions involve a temperature in the interval 250-400°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.1-2 and wherein the material catalytically active in hydrotreatment comprises one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising one or more refractory oxides, such as alumina, silica or titania.

12. The process according to claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11, wherein hydrocracking conditions involve a temperature in the interval 250-400°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-4, optionally together with intermediate cooling by quenching with cold hydrogen, feed or product and wherein the material catalytically active in hydrocracking comprises (a) one or more active metals taken from the group platinum, palladium, nickel, cobalt, tungsten and molybdenum, (b) an acidic support taken from the group of a molecular sieve showing high cracking activity, and having a topology such as MFI, BEA and FAU and amorphous acidic oxides such

as silica-alumina and (c) a refractory support such as alumina, silica or titania, or combinations thereof).

13. The process according to claim 4 or a claim dependent thereon, wherein isomerization conditions involves a temperature in the interval 250-350°C, a pressure in the interval 30-150 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-8 and wherein the material catalytically active in isomerization comprises an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium, an acidic support preferably a molecular sieve, more preferably having a topology taken from the group comprising MOR, FER, MRE, MWW, AEL, TON and MTT and an amorphous refractory support comprising one or more oxides taken from the group comprising alumina, silica and titania.

14. The process according to claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 or 13, wherein hydrodearomatization conditions involve a temperature in the interval 200-350°C, a pressure in the interval 20-100 Bar, and a liquid hourly space velocity (LHSV) in the interval 0.5-8 and wherein said material catalytically active in hydrodearomatization comprises an active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium and a refractory support, preferably amorphous silica-alumina, alumina, silica or titania, or combinations thereof.

15. A process plant for production of a hydrocarbon suitable for use as a jet fuel (106, 218) from a feedstock (2, 202) being a renewable feedstock or an oxygenate feedstock, comprising a hydrotreatment section (8, HDO) containing a material catalytically active in hydrodeoxygenation comprising one or more sulfided metals taken from the group of nickel, cobalt, molybdenum or tungsten, supported on a carrier comprising an amorphous refractory oxides, a hydrocracking section (16) containing a material catalytically active in hydrocracking, comprising one or more sulfided base metals such as nickel, cobalt, tungsten and/or molybdenum, an acidic support and a refractory support and a hydrodearomatization section (86) containing a material catalytically active in hydrodearomatization comprising an

active metal taken from the group comprising platinum, palladium, nickel, cobalt, tungsten and molybdenum, preferably one or more elemental noble metals such as platinum or palladium and a refractory support, preferably amorphous silica-alumina, alumina, silica or titania, or combinations thereof, said process plant being configured for

a. directing the feedstock (2, 2a, 2b, 2c, 2d, 202) to the hydrotreatment section (8, HDO) to provide a hydrotreated intermediate product (14, 206),
b. directing the hydrotreated intermediate product (14, 206) to the hydrocracking section (16, HDC) to provide a hydrocracked intermediate product (22 212),
c. directing at least an amount of said hydrocracked intermediate product (22, 212) to a hydrodearomatization section (86, HDA) to provide a treated product (92) comprising the hydrocarbon fraction suitable for use as a jet fuel (106, 218) wherein said treated product (92, 218) comprises less than 1 wt/wt% aromatics, calculated by total mass of aromatic molecules relative to all hydrocarbons in the stream.