CLAIMS

1. A process for the selective hydrogenation of diolefins and sulfur compounds contained in a pyrolysis gasoline feedstock, having a diolefin concentration and an organic sulfur concentration, wherein said process comprises:

introducing a hydrocarbon stream that comprises said pyrolysis gasoline feedstock into a reactor that is loaded with a high activity hydrotreating catalyst and operated at selective hydrogenation conditions, wherein said hydrocarbon stream is contacted with said high activity hydrotreating catalyst;

yielding from said reactor a reactor effluent having a reduced diolefin concentration and a reduced organic sulfur concentration;

separating said reactor effluent into a portion of said reactor effluent and a remaining portion of said reactor effluent; and

introducing as a recycle said portion of said reactor effluent into said reactor.

2. A process as recited in claim 1, wherein said diolefin concentration exceeds 3 wt % and said reduced diolefin concentration is less than 10 ppmw, and wherein said organic sulfur concentration exceeds 50 ppmw and said reduced organic sulfur concentration is less than 3 ppmw.

3. A process as recited in claim 2, wherein said reactor effluent from a reactor outlet of said reactor has an aromatics content of at least 90 wt % of a reactor inlet aromatics content.

4. A process as recited in claim 3, wherein the weight ratio of said recycle-to-said hydrocarbon stream is greater than 1:1.

5. A process as recited in claim 4, wherein said selective hydrogenation conditions include a feed inlet temperature to said reactor that is in the range of from 100 °C to 250 °C, a reactor

operating pressure in the range of from 10 bara to 100 bara, and a weight hourly space velocity in the range of from 0.2 to 40 hr^{-1}.

6. A process as recited in claim 5, wherein said pyrolysis gasoline feedstock further comprises monoolefins at a concentration in the range of from 1 to 20 wt % and aromatics at a concentration in the range of from 10 wt % to 80 wt %, and wherein said reactor effluent has a reduced monoolefin concentration as measured by a bromine number of less than 1 and aromatics content of at least 95 wt % of said hydrocarbon stream.

7. A process as recited in claim 5, wherein said high activity hydrotreating catalyst comprises molybdenum and either nickel or cobalt supported on alumina.

8. A process as recited in claim 7, wherein said reactor is a vessel that defines at least one selective hydrogenation reaction zone containing said high activity hydrotreating catalyst and having a reactor inlet for receiving into said vessel said hydrocarbon stream and said recycle and a reactor outlet for withdrawing said reactor effluent.

9. A process as recited in claim 8, wherein said step of separating said reactor effluent includes:

separating said reactor effluent into a total reactor effluent portion of said reactor effluent and a total reactor effluent remaining portion of said reactor effluent, and

using said total reactor effluent portion as a total recycle stream of said recycle.

10. A process as recited in claim 8, wherein said step of separating said reactor effluent includes:

passing said reactor effluent to a separator for separating said reactor effluent into a liquid fraction and a vapor fraction;

passing said liquid fraction to a fractionator for separating said liquid fraction into a light cut and a heavy cut;

separating said heavy cut into a heavy cut portion of said heavy cut and a heavy cut remaining portion of said heavy cut; and

using said heavy cut portion of said heavy cut as a heavy cut recycle stream of said recycle.

11. A process as recited in claim 8, wherein said step of separating said reactor effluent includes:

passing said reactor effluent to a separator for separating said reactor effluent into a liquid fraction and a vapor fraction;

separating said liquid fraction into a liquid fraction portion of said liquid fraction and a liquid fraction remaining portion of said liquid fraction; and

using said liquid fraction portion of said liquid fraction as a first recycle stream of said recycle.

12. A process as recited in claim 11, wherein said step of separating said reactor effluent further includes:

passing said liquid fraction remaining portion of said liquid fraction to a fractionator for separating said liquid fraction remaining portion of said liquid fraction into a light cut and a heavy cut;

separating said heavy cut into a heavy cut portion of said heavy cut and a heavy cut remaining portion of said heavy cut; and

using said heavy cut portion of said heavy cut as a second recycle stream of said recycle.

13. A process as recited in any one of claims 10, 11, and 12, further comprising:

introducing said vapor fraction into said reactor along with said hydrocarbon stream and said recycle.

14. A process for the selective hydrogenation of monoolefins, diolefins, and sulfur compounds contained in a pyrolysis gasoline feedstock, wherein said pyrolysis gasoline feedstock having a monoolefins concentration, a diolefins concentration, an aromatics concentration, and an organic sulfur concentration, and wherein said process comprises:

introducing a hydrocarbon stream that comprises said pyrolysis gasoline feedstock into a reactor that is loaded with a high activity hydrotreating catalyst and operated under selective hydrogenation conditions, wherein said hydrocarbon stream is contacted with said high activity hydrotreating catalyst;

yielding from a reactor outlet of said reactor a reactor effluent having a reduced monoolefin concentration, a reduced diolefin concentration, a reduced organic sulfur concentration, and an aromatics content of at least 90 wt % of a reactor inlet aromatics content; and

15. A process as recited in claim 14, wherein said monoolefins concentration is in the range of from 1 to 20 wt %, said diolefins concentration exceeds 3 wt %, said aromatics concentration is in the range of from 10 wt % to 80 wt %, and said organic sulfur concentration exceeds 50 ppmw, and wherein said reduced monoolefin concentration is measured by a bromine number of less than 1, said reduced diolefin concentration is less than 10 ppmw, and said reduced organic sulfur concentration is less than 3 ppmw.

16. A process as recited in claim 15, further comprising:

introducing into said reactor with said hydrocarbon stream a portion of said reactor effluent as a recycle at a rate so as to provide a weight ratio recycle-to-hydrocarbon stream that is greater than 1:1.

~~17. A process as recited in claim 16,~~ wherein said selective hydrogenation conditions include a feed inlet temperature ~~to said reactor~~ that is in the range of from 100 °C to 250 °C, a reactor operating pressure in the range of from 10 bara ~~to 100 bara~~, and a weight hourly space velocity in the range of from 0.2 to 40 hr^{-1}.

~~18. A process as recited in claim 17,~~ wherein said high activity hydrotreating catalyst comprises molybdenum and either nickel or cobalt supported on alumina.