CLAIMS

1. A process to make an alkylate gasoline, comprising:

a. providing an olefin feed, comprising at least 8 wt% pentenes, a butene, and less than 60 wt% isopentane, wherein the olefin feed comprises C3, C4 and C5 olefins, wherein an amount of the pentenes in the olefin feed is from 35 to 100 mol% of a total olefins in the olefin feed;

b. providing an isoparaffin feed comprising an isobutane; and

c. alkylating the olefin feed with the isoparaffin feed using an acidic ionic liquid alkylation catalyst under alkylation conditions to make the alkylate gasoline, wherein the alkylation conditions include a catalyst volume in an alkylation reactor of 2 vol % to 50 vol %, an alkylation temperature of -10°C to 100°C, an alkylating pressure of 300 kPa to 2500 kPa, an isoparaffin to olefin molar ratio of 2 to 16 and a residence time of 30 seconds to 1 hour;

wherein a yield of isopentane in the alkylate gasoline corresponds to less than 15 mol% of C5 olefins in the olefin feed and wherein the alkylate gasoline has a final boiling point from 370 °F (187.8 °Celsius) to 400 °F (204.4 °Celsius) and a RON of 85 or greater.

2. The process of claim 1, wherein the acidic ionic liquid alkylation catalyst conducts simultaneous conversion of the isobutane and the isopentane into the alkylate gasoline during the alkylating.

3. The process of claim 1, additionally comprising: isolating a C5 olefin stream from a FCC unit to provide the olefin feed and the alkylating converts the C5 olefin stream to the alkylate gasoline without increasing a throughput from the FCC unit.

4. The process of claim 1, wherein the alkylating converts 100 wt% of the olefins in the olefin feed.

5. The process of claim 1, wherein an amount of a trimethylpentane in C8 hydrocarbons in the alkylate gasoline is from 70 to 95 wt%.

6. The process of claim 1, wherein an amount of a trimethylhexane in C9 hydrocarbons in the alkylate gasoline is from 85 to 95 wt%.

7. The process of claim 1, wherein the alkylate gasoline comprises a C5+ alkylate fraction having a RVP from 2.3 to 6.0 psi (15.9 to 41.4 kPa).

8. The process of claim 1, wherein the RON is from 90.0 to 94.5.

9. The process of claim 1, wherein a level of the pentenes in the olefin feed is increased and does not create a deleterious formation of a conjunct polymer in the acidic ionic liquid alkylation catalyst during the alkylating.

10. The process of claim 1, wherein an w-pentane product yield relative to a total olefin content in the olefin feed is from zero to less than 0.2 mol/mol.

11. The process of claim 1, additionally comprising selectively hydrogenating a refinery olefin stream to make the olefin feed, and wherein the olefin feed comprises from zero to 0.5 wt% dienes.

12. The process of claim 1, additionally comprising selectively hydrogenating the olefin feed to increase the RON or a MON of the alkylate gasoline.