IT IS CLAIMED:

1. A process for making one or more alkylate products, comprising:

a. dehydrogenating a natural gas feedstock comprising saturated hydrocarbons in a dehydrogenation reactor to produce a mixture comprising one or more olefins, wherein the one or more olefins is at least 60 wt% isopentene, and one or more unconverted paraffins;

b. without further purification or modification other than mixing with isopentane, sending the mixture mixed with isopentane to a single alkylation reactor that is not thermally coupled with the dehydrogenation reactor; and

c. alkylating the one or more olefins with isopentane in the single alkylation reactor, using an ionic liquid catalyst, to produce the one or more alkylate products comprising an alkylate middle distillate with a smoke point of 35 or higher, a freeze point of -40°C or lower, a Bromine number less than 2, and 10 wppm or less sulfur;

wherein the one or more alkylate products are selected from the group consisting of an alkylate jet fuel, an alkylate diesel fuel, and mixtures thereof.

2. The process of claim 1, wherein the natural gas feedstock comprises from C5 to C6 paraffins.

3. The process of claim 1, wherein the mixture comprises from 30 to 80 wt% of the one or more unconverted paraffins.

4. The process of claim 1, wherein a molar ratio of the isopentane to the one or more olefins in the single alkylation reactor is from 4:1 to 12:1.

5. The process of claim 1, wherein dehydrogenating conditions include a pressure from 0 to 100 psig, and a temperature from 400 ºC to 900 ºC.

6. The process of claim 1, additionally comprising:

d. distilling an effluent from the single alkylation reactor into separate fractions comprising:

the one or more alkylate products,

an unreacted isopentane fraction, and

an unreacted paraffin fraction;

e. recycling the unreacted isopentane fraction to the single alkylation reactor; and

f. recycling the unreacted paraffin fraction to the dehydrogenation reactor.

7. The process of claim 1, wherein the dehydrogenating is performed with a dehydrogenation catalyst comprising Pt/Al_2O_3, Cr/Al_2O_3, Pt/Carbon or a combination thereof.

8. The process of claim 1, additionally comprising maintaining an overall alkylation activity of the ionic liquid catalyst by separating a used ionic liquid catalyst from an effluent of the single alkylation reactor, regenerating a portion of the used ionic liquid catalyst, and returning both a regenerated ionic liquid catalyst and the used ionic liquid catalyst to the single alkylation reactor.

9. The process of claim 1, wherein a co-catalyst comprising a chloride is added to the ionic liquid catalyst.

10. The process of claim 1, wherein the natural gas feedstock is produced by a hydraulic fracturing.

11. The process of claim 1, additionally comprising isomerizing the natural gas feedstock prior to the dehydrogenating, wherein the isomerizing converts some n-pentane in the natural gas feedstock to isopentane that is subsequently alkylated in the single alkylation reactor.