WHAT IS CLAIMED IS:

1. A method of alkylating isobutane, comprising:

passing a feed mixture consisting of excess isobutane and C2 to C5 olefins into a reaction chamber;

wherein the reaction chamber comprises:

a crystalline zeolite catalyst comprising sodalite cages and supercages, a Si/Al molar ratio of 20 or less, less than 0.5 weight percent alkali metals; and up to 5 wt% of Pt, Pd and or Ni, and acid-site density (including both Lewis and Brønsted acid sites) of at least 100 μmole/gm; and

a RE-modified molecular sieve adsorbent (Re-MSA) comprising sodalite cages and supercages, a Si/Al molar ratio of 20 or less, less than 1 wt% of alkali metals, RE (rare earth elements) in the range of 10 to 30 wt% and transition metals selected from groups 9-11 in the range from 2 wt% to 10 wt, and acid-site density of no more than 30 μmole/gm.

2. A method of claim 1, comprising:

wherein, at steady state, at least 90% of the C2-C5 olefins are converted to products and wherein the Research Octane Number (RON) remains above 90; and conducting the process for a catalyst age of 2.5 or greater over the same catalyst without regeneration; and

wherein steady state means that the selectivity to C8 isomers changes by 10% or less over the entire period that the catalyst age is determined.

3. The method of claim 1 or 2, comprising:

wherein the crystalline zeolite catalyst comprises rare earth elements in the range of 10 to 35 wt%;

wherein the Re-MSA comprises a micro-pore diameter of at least 8 Angstroms, or in the range of 8 to 12 Å.

4. The method of any of claims 1-3 conducted at a pressure of 250 to 400 psig.

5. The method of any of claims 1-3 wherein the concentration of C2 to C5 olefins in the feed is between 1 wt% and 30 wt%.

6. The method of any of claims 1-3 wherein the ratio of the concentration of iso-butane to the concentration of C2-C5 olefins at the entrance of the catalyst bed is between 100-1000 mol/mol.

7. The method of any of claims 1-3 wherein the olefin space velocity is between 0.05/hr to 0.5/hr

8. The method of any of claims 1-3 wherein the catalyst and Re-MSA is regenerated in a flowing gas stream that is essentially hydrogen at a temperature of at least 250 °C; and wherein the catalyst comprises 0.1 wt% to 5 wt%, or 0.5 to 4 wt%, or 1.0 to 3.0 wt%, of an element selected from the group consisting of Pt, Pd, Ni, and combinations thereof.

9. The method of any of claims 1-4 wherein the catalyst and Re-MSA is regenerated with a flow of gas which is at least 50 volume% hydrogen.

10. The method of any of claims 1-4 wherein the catalyst and Re-MSA is regenerated in flowing hydrogen at a temperature of at least 250 °C and a GHSV of at least 500.

11. The method of any of claims 1-10 wherein the method is run continuously for a catalyst age of 2-3.5 without regenerating the catalyst or Re-MSA.

12. The method of any of claims 1-7 wherein the reaction chamber comprises a packed catalyst bed followed by a Re-MSA bed.

13. The method of any of claims 1-7 wherein the reaction chamber comprises a packed Re-MSA bed followed by a catalyst bed.

14. The method of any of claims 1-7 wherein the reaction chamber comprises alternating beds of catalyst and Re-MSA comprising at least 2 catalyst beds and 2 Re-MSA beds.

15. The method of any of claims 1-7 wherein the reaction chamber comprises a packed bed consisting of mixture of catalyst and Re-MSA.

16. The method of any of claims 1-9 wherein the ratio of the Re-MSA weight to catalyst weight in the reaction chamber is between 0.1 to 10 wt/wt.

17. The method of any of claims 1-7 wherein the reaction chamber comprises a packed bed of particles, comprising catalyst and Re-MSA wherein at least 95 wt% of the particles have particle

diameters of at least 0.1 mm.

18. The method of any of the previous claims conducted at a temperature between 45 and 90 °C.

19. The method of any of claims 1-18 wherein the C2 to C5 olefin contains less than 100 ppm water.

20. The method of any of the previous claims comprising conducting the process for a catalyst age of 2.5 or a catalyst age of 3.0.