WHAT IS CLAIMED IS:

1. A catalytic process for selective isomerization of 2-ethyl-1-butene in a linear alpha olefin product stream, comprising:

feeding a linear alpha olefin product stream comprising at least one linear alpha olefin, such as 1-hexene, and 2-ethyl-1-butene to a reactor housing a modified alumina catalyst to isomerize at least a portion of the 2-ethyl-1-butene to cis- or trans-3-methyl-2-pentene, the period during which said feeding occurs being time on stream;

withdrawing an effluent from the reactor containing less 2-ethyl-1-butene than the linear alpha olefin product stream; and

periodically regenerating the modified alumina catalyst by stopping the feeding step and introducing a non-oxidizing environment to the reactor at time on stream intervals of no more than 200 hours, wherein the reactor is subjected to the non-oxidizing environment for a time period of 15 hours or greater and wherein the non-oxidizing environment has a temperature of 250 °C or greater for at least a portion of the time period.

2. The catalytic process of claim 1, wherein the non-oxidizing environment comprises a vacuum environment or an inert gas environment, such as nitrogen or a noble gas environment.

3. The catalytic process of claim 1 or 2, wherein the regenerating comprises passing an inert gas through the reactor in two sequential stages comprising i) a first lower temperature stage comprising passing the inert gas through the reactor at an inert gas temperature of 200 °C or less for a time period of 2 hours or greater; and ii) a second higher temperature stage comprising passing the inert gas through the reactor at an inert gas temperature of 250 °C or greater for a time period of 8 hours or greater.

4. The catalytic process of claim 3, wherein the first lower temperature stage comprises one or more of:

passing the inert gas through the reactor at an inert gas temperature of 150 °C or less;

passing the inert gas through the reactor at an inert gas temperature of 40 °C to 150 °C;

passing the inert gas through the reactor at multiple inert gas temperatures ranging from 40 °C to 150 °C, wherein the inert gas temperature is increased to each of the multiple inert gas temperatures at a rate of about 1 to about 5 °C/min;

passing the inert gas through the reactor for a time period of 4 hours or greater; and

passing the inert gas through the reactor for a time period of 2 to 6 hours.

5. The catalytic process of claim 3, wherein the second higher temperature stage comprises one or more of:

passing the inert gas through the reactor at an inert gas temperature of 300 °C or less;

passing the inert gas through the reactor at an inert gas temperature of 250 °C to 300 °C;

passing the inert gas through the reactor for a time period of 14 hours or less; and

passing the inert gas through the reactor for a time period of 8 to 12 hours.

6. The catalytic process of any one of claims 3 to 5, wherein the transition from the first lower temperature stage to the second higher temperature stage occurs at a rate of 1 to 5 °C/min.

7. The catalytic process of any one of claims 3 to 6, wherein the inert gas flow rate is 120 to 300 cm^3/min.

8. The catalytic process of any one of claims 1 to 7, further comprising periodically regenerating the modified alumina catalyst by stopping the feeding step and introducing an oxidizing gas to the reactor.

9. The catalytic process of claim 8, wherein the oxidizing gas comprises oxygen at a gas temperature of 300 °C to 450 °C, optionally introducing the oxidizing gas for a time period of 1 to 24 hours.

10. The catalytic process of any one of claims 1 to 9, wherein the modified alumina catalyst is capable of converting 80 wt.% or greater of 2-ethyl-1-butene to cis- or trans-3-methyl-2-pentene at a pressure of 0.1 - 10 barg, a temperature of 40 - 100 °C, and a Liquid Hourly Space Velocity of 0.5 - 10 h^{-1}, and wherein 3 wt.% or less of 1-hexene is converted to a different isomer under the same reaction conditions.

11. The catalytic process of any one of claims 1 to 10, further comprising feeding the effluent from the reactor to a distillation column to produce an overhead stream comprising the linear alpha olefin and a bottoms stream comprising cis- or trans-3-methyl-2-pentene.

12. The catalytic process of claim 11, wherein the overhead stream comprises 99.5 wt.% 1-hexene or greater and 0.15 wt.% of 2-ethyl-1-butene or an isomer thereof or less.

13. The catalytic process of any one of claims 1 to 12, wherein the modified alumina catalyst has 0.01 to 0.5 mmol/g catalyst of Brønsted acid sites as determined by FTIR spectroscopy using pyridine as probe molecule.

14. The catalytic process of claim 13, wherein the modified alumina catalyst has 0.04 to 0.2 mmol/g catalyst of Brønsted acid sites as determined by FTIR spectroscopy using pyridine as probe molecule.