CLAIMS

What is claimed:

~~1. A process for the double-bond isomerization of olefins, the process comprising:~~

~~contacting a fluid stream comprising olefins with a fixed bed comprising an activated basic metal oxide isomerization catalyst comprising a structure stabilizing agent,to convert at least a portion of the olefin to its isomer.~~

~~2. The process of claim 1, wherein the basic metal oxide isomerization catalyst comprises at least one of magnesium oxide, calcium oxide, strontium oxide, barium oxide, lithium oxide, and combinations thereof.~~

~~3. The process of claim 1, wherein the basic metal oxide isomerization catalyst comprises magnesium oxide.~~

~~4. The process of claim 1, wherein the structure stabilizing agent comprises at least one of elements Al, Si, Ti, Cr, Mn, Fe, Y, Zr, Mo, and combinations thereof.~~

~~5. The process of claim 1, wherein the catalyst comprises 0.04 weight% to 40 weight% of the structure stabilizing agent.~~

~~6. The process of claim 1, wherein the structure stabilizing agent is in the form of a binder comprising at least one of silica, alumina, and natural clays.~~

~~7. The process of claim 1, wherein the structure stabilizing agent comprises at least one of a compound and a mixture.~~

~~8. The process of claim 1, wherein the catalyst has an effective diameter in the range from about 0.25 mm to about 5.0 mm.~~

~~9. The process of claim 1, wherein the catalyst has an effective diameter in the range from about 0.5 mm to about 3.2 mm.~~

~~10. The process of claim 1 wherein the catalyst is in the form of a tablet or an extrudate.~~

~~11. The process of claim 1, wherein an initial activity of the basic metal oxide isomerization catalyst is a 2-butene to 1-butene product ratio of at least 3.0, as measured by conversion of pure 1-butene to 2-butene in the presence of at least an equimolar amount of ethylene at a temperature of 600°F and a pressure of 400 psig.~~

~~12.~~1. A process for the double-bond isomerization of olefins, the process comprising:

contacting a fluid stream comprising olefins with a fixed bed comprising an activated basic metal oxide isomerization catalyst having an effective diameter in the range of 0.25 mm to 4.0 mm to convert at least a portion of the olefin to its isomer.

~~13.~~2. The process of claim ~~12~~1, wherein the basic metal oxide isomerization catalyst comprises at least one of magnesium oxide, calcium oxide, strontium oxide, barium oxide, lithium oxide, and combinations thereof.

~~14.~~3. The process of claim ~~12~~1, wherein the basic metal oxide isomerization catalyst comprises magnesium oxide.

~~15.~~4. The process of claim ~~12~~1, wherein the effective diameter of the catalyst is in the range from about 0.5 mm to about 3.2 mm.

~~16.~~5. The process of claim ~~12~~1 wherein the catalyst is in the form of a tablet or an extrudate.

~~17. A process for the production of propylene, comprising:~~

~~fractionating a hydrocarbon stream comprising n-butenes, isobutene, and paraffins into at least two fractions including a light C_4 fraction comprising isobutene and a heavy C_4 fraction comprising n-butenes and paraffins;~~

~~feeding ethylene and the heavy C_4 fraction to a fixed bed reactor comprising a metathesis catalyst and an activated basic metal oxide isomerization catalyst comprising a structure stabilizing agent;~~

~~contacting the heavy C_4 fraction with the activated basic metal oxide isomerization catalyst to convert at least a portion of the 1-butene to 2-butene; and~~

~~contacting ethylene and at least a portion of the 2-butene with a metathesis catalyst to form a metathesis product comprising propylene, paraffins, any unreacted ethylene, and any unreacted 1-butene and 2-butene.~~

~~18. The process of claim 17, further comprising fractionating the metathesis product to recover an ethylene fraction, a propylene fraction, and a C_4 fraction.~~

~~19. The process of claim 17, further comprising recycling at least a portion of the C_4 fraction to the fractionating a hydrocarbon stream.~~

~~20. The process of claim 17, further comprising recycling at least a portion of the ethylene fraction to the fixed bed reactor.~~

~~21. The process of claim 17, further comprising maintaining a ratio of ethylene to n-butene fed to the fixed bed reactor in a range from about 0.5 to about 2.5.~~

~~22. The process of claim 21, wherein the ratio of ethylene to n-butene fed is at least 1.0.~~

~~23. The process of claim 17, wherein the metathesis catalyst is admixed with the isomerization catalyst.~~

~~24. The process of claim 17, wherein the fixed bed reactor comprises a bed of the metathesis catalyst and a bed of the isomerization catalyst.~~

~~25. The process of claim 17, wherein the hydrocarbon stream further comprises butadiene, the process further comprising hydrogenating at least a portion of the butadiene prior to the fractionating.~~

~~26. The process of claim 17, wherein the basic metal oxide isomerization catalyst comprises at least one of magnesium oxide, calcium oxide, strontium oxide, barium oxide, lithium oxide, and combinations thereof.~~

~~27. The process of claim 17, wherein the basic metal oxide isomerization catalyst comprises magnesium oxide.~~

~~28. The process of claim 17, wherein the structure stabilizing agent comprises at least one of elements Si, Al, Zr, Mn, Cr, Fe, Y and combinations thereof.~~

~~29. The process of claim 17, wherein the catalyst comprises 0.04 weight% to 40 weight% of the structure stabilizing agent.~~

~~30. The process of claim 17, wherein the structure stabilizing agent is in the form of a binder comprising at least one of silica, alumina, and natural clay.~~

~~31. The process of claim 17, wherein the catalyst has an effective diameter in the range from about 0.25 mm to about 5.0 mm.~~

~~32. The process of claim 17, wherein the catalyst has an effective diameter in the range from about 0.5 mm to about 3.2 mm.~~

~~33.~~6. A process for the production of propylene, comprising:

fractionating a hydrocarbon stream comprising n-butenes, isobutene, and paraffins into at least two fractions including a light C_4 fraction comprising isobutene and a heavy C_4 fraction comprising n-butenes and paraffins;

feeding ethylene and the heavy C_4 fraction to a fixed bed reactor comprising a metathesis catalyst and activated basic metal oxide isomerization catalyst wherein the isomerization catalyst has an effective diameter between 0.25 and 4.0 mm and does not contain a stabilizing agent;

contacting the heavy C_4 fraction with the activated basic metal oxide isomerization catalyst to convert at least a portion of the 1-butene to 2-butene; and

contacting the ethylene and at least a portion of the 2-butene with a metathesis catalyst to form a metathesis product comprising propylene, paraffins, any unreacted ethylene, and any unreacted 1-butene and 2-butene.

~~34.~~7. The process of claim ~~33~~6, further comprising fractionating the metathesis product to recover an ethylene fraction, a propylene fraction, and a C_4 fraction.

~~35.~~8. The process of claim ~~34~~3-6 further comprising recycling at least a portion of the C_4 fraction to the fractionating a hydrocarbon stream.

~~36.~~9. The process of claim ~~33~~6, further comprising recycling at least a portion of the ethylene fraction to the fixed bed reactor.

~~37.~~10. The process of claim ~~33~~6, further comprising maintaining a ratio of ethylene to n-butene fed to the fixed bed reactor in a range from about 0.5 to about 2.5.

~~38.~~11. The process of claim ~~37~~10, wherein the ratio of ethylene to n-butene fed is at least 1.0.

~~39.~~12. The process of claim ~~33~~6, wherein the metathesis catalyst is admixed with the isomerization catalyst.

~~40.~~13. The process of claim ~~33~~6, wherein the fixed bed reactor comprises a bed of the metathesis catalyst and a bed of the isomerization catalyst.

~~41.~~14. The process of claim ~~33~~6, wherein the hydrocarbon stream further comprises butadiene, the process further comprising hydrogenating at least a portion of the butadiene prior to the fractionating.

~~42.~~15. The process of claim ~~33~~6, wherein the basic metal oxide isomerization catalyst comprises at least one of magnesium oxide, calcium oxide, strontium oxide, barium oxide, lithium oxide, and combinations thereof.

~~43.~~16. The process of claim ~~33~~6, wherein the basic metal oxide isomerization catalyst comprises magnesium oxide.

~~44.~~17. The process of claim ~~33~~6, wherein the catalyst has an effective diameter in the range from about 1.0 mm to about 3.5 mm.

~~45.~~18. The process of claim ~~33~~6, wherein the catalyst has an effective diameter in the range from about 1.5 mm to about 3.2 mm.

~~46.~~19. The process of claim ~~33~~-6 wherein the catalyst is in the form of a tablet or extrudate.