CLAIMS

What is claimed is:

1. A process comprising:

a) separating a composition comprising an oligomer product, the oligomer product comprising from 15 to 75 mol % C_6 olefins, from 20 to 80 mol % C_8 olefins, and from 5 to 20 mol % C_{10}+ olefins, into

i) a first oligomer composition comprising C_6 alkanes and at least 85 mol % C_6 olefins, the C_6 olefins comprising at least 80 mol % 1-hexene,

ii) a second oligomer composition comprising at least 85 mol % C_8 olefins, the C_8 olefins comprising at least 85 mol % 1-octene, and

iii) a heavies stream comprising C_{10}+ olefins;

b) contacting a metathesis catalyst system with all or a portion of the first oligomer composition to form a first composition comprising C_{10} linear internal olefins;

c) contacting the C_{10} linear internal olefins with an isomerization hydrofunctionalization catalyst system to form a second composition comprising a functionalized alkane;

d) retro-hydrofunctionalizing the functionalized alkane to form a third composition comprising 1-decene; and

e) purifying the third composition to isolate a fourth composition comprising at least 90 mol % 1-decene.

2. The process of claim 1, wherein the oligomer product comprises from 30 to 65 mol % C_6 olefins, from 30 to 65 mol % C_8 olefins, and from 5 to 18 mol % C_{10}+ olefins.

3. The process of claim 1, wherein:

the first oligomer composition comprises from 1.5 to 8 mol % C_6 alkanes and at least 90 mol % C_6 olefins; and

the C_6 olefins comprises at least 90 mol % 1-hexene and from 0.5 to 8 mol % internal and cyclic C_6 olefins.

4. The process of claim 1, wherein:

the second oligomer composition comprises at least 95 mol % C_8 olefins; and

the C_8 olefins comprise at least 95 mol % 1-octene.

5. The process of claim 1, further comprising a step of isolating an internal olefin composition comprising at least 90 mol % C_{10} linear internal olefins from the first composition prior to step c).

6. The process of claim 1, wherein:

step c) comprises contacting the C_{10} linear internal olefins with a hydroformylation catalyst system, carbon monoxide, and hydrogen to form the second composition comprising C_{11} aldehydes; and

step d) comprises contacting the C_{11} aldehydes with a dehydroformylation catalyst system to form the third composition comprising 1-decene.

7. The process of claim 6, further comprising a step of isolating an aldehyde composition comprising at least 90 mol % C_{11} aldehydes from the second composition prior to step d).

8. The process of claim 6, wherein the dehydroformylation catalyst system comprises i) a transition metal compound, a phosphine, and a heteroatomic acid or heteroatomic acid derivative, or ii) a phosphine transition metal compound complex and a heteroatomic acid or heteroatomic acid derivative.

9. The process of claim 1, further comprising a step of contacting the metathesis catalyst system with all or a portion of the second oligomer composition to form a C_{14} olefin composition.

10. The process of claim 1, wherein the fourth composition comprises at least 95 mol % 1-decene.

11. A process comprising:

a) separating a composition comprising an oligomer product, the oligomer product comprising at least 85 mol % C_6 olefins and at least 5 mol % C_8+ olefins, into

i) a first oligomer composition comprising C_6 alkanes and at least 90 mol % C_6 olefins, the C_6 olefins comprising at least 90 mol % 1-hexene, and

ii) a heavies stream comprising C_8+ olefins;

b) contacting a metathesis catalyst system with all or a portion of the first oligomer composition to form a first composition comprising C_{10} linear internal olefins;

c) contacting the C_{10} linear internal olefins with an isomerization hydrofunctionalization catalyst system to form a second composition comprising a functionalized alkane;

d) retro-hydrofunctionalizing the functionalized alkane to form a third composition comprising 1-decene; and

e) purifying the third composition to isolate a fourth composition comprising at least 90 mol % 1-decene.

12. The process of claim 11, wherein the oligomer product comprises at least 90 mol % C_6 olefins.

13. The process of claim 11, wherein:

the first oligomer composition comprises at least 94 mol % C_6 olefins; and

the C_6 olefins comprises at least 96 mol % 1-hexene.

14. The process of claim 11, further comprising a step of isolating an internal olefin composition comprising at least 90 mol % C_{10} linear internal olefins from the first composition prior to step c).

15. The process of claim 11, wherein:

step c) comprises contacting the C_{10} linear internal olefins with a hydroformylation catalyst system, carbon monoxide, and hydrogen to form the second composition comprising C_{11} aldehydes;

step d) comprises contacting the C_{11} aldehydes with a dehydroformylation catalyst system to form the third composition comprising 1-decene; and

the process further comprises a step of isolating an aldehyde composition comprising at least 90 mol % C_{11} aldehydes from the second composition prior to step d).

16. A 1-octene/1-decene manufacturing system comprising:

1) an ethylene oligomerization system configured to oligomerize ethylene in the presence of a catalyst system or catalyst system components to form a composition comprising an oligomer product, the oligomer product comprising from 15 to 75 mol % C_6 olefins, from 20 to 80 mol % C_8 olefins, and from 5 to 20 mol % C_{10}+ olefins;

2) a fractionation system configured to separate the composition comprising the oligomer product into i) a first oligomer composition comprising 1-hexene, ii) a second oligomer composition comprising 1-octene, and iii) a heavies stream comprising C_{10}+ olefins;

3) a metathesis system configured to contact a metathesis catalyst system with all or a portion of the first oligomer composition to form a first composition comprising C_{10} linear internal olefins;

4) an isomerization hydrofunctionalization system configured to contact the C_{10} linear internal olefins with an isomerization hydrofunctionalization catalyst system to form a second composition comprising a functionalized alkane;

5) a retro-hydrofunctionalization system configured to treat the functionalized alkane to form a third composition comprising 1-decene; and

6) a purification system configured to isolate a fourth composition comprising at least 90 mol % 1-decene from the third composition.

17. The manufacturing system of claim 16, further comprising a metathesis purification system configured to isolate a composition comprising C_{10} linear internal olefins from the first composition prior to the isomerization hydrofunctionalization system.

18. The manufacturing system of claim 16, further comprising a isomerization hydrofunctionalization purification system configured to isolate a composition comprising functionalized alkanes from the second composition prior to the retro-hydrofunctionalization system.

19. The manufacturing system of claim 16, wherein the catalyst system or catalyst system components comprise a heteroatomic ligand chromium compound complex and an alkylaluminum compound, or a heteroatomic ligand, a chromium compound, and an alkylaluminum compound.

20. A 1-hexene/1-decene manufacturing system comprising:

1) an ethylene oligomerization system configured to oligomerize ethylene in the presence of a catalyst system or catalyst system components to form a composition comprising an oligomer product, the oligomer product comprising at least 85 mol % C_6 olefins and at least 5 mol % C_8+ olefins;

2) a fractionation system configured to separate the composition comprising the oligomer product into a first oligomer composition comprising 1-hexene and a heavies stream comprising C_8+ olefins;

3) a metathesis system configured to contact a metathesis catalyst system with all or a portion of the first oligomer composition to form a first composition comprising C_{10} linear internal olefins;

4) an isomerization hydrofunctionalization system configured to contact the C_{10} linear internal olefins with an isomerization hydrofunctionalization catalyst system to form a second composition comprising a functionalized alkane;

5) a retro-hydrofunctionalization system configured to treat the functionalized alkane to form a third composition comprising 1-decene; and

6) a purification system configured to isolate a fourth composition comprising at least 90 mol % 1-decene from the third composition.

21. The process of claim 11, wherein the fourth composition comprises at least 95 mol % 1-decene.

22. The process of claim 11, wherein:

step c) comprises contacting the C_{10} linear internal olefins with a hydroformylation catalyst system, carbon monoxide, and hydrogen to form the second composition comprising C_{11} aldehydes; and

step d) comprises contacting the C_{11} aldehydes with a dehydroformylation catalyst system to form the third composition comprising 1-decene.

23. The process of claim 22, further comprising a step of isolating an aldehyde composition comprising at least 93 mol % C_{11} aldehydes from the second composition prior to step d).

24. The process of claim 22, wherein the dehydroformylation catalyst system comprises i) a transition metal compound, a phosphine, and a heteroatomic acid or heteroatomic acid derivative, or ii) a phosphine transition metal compound complex and a heteroatomic acid or heteroatomic acid derivative.

25. The manufacturing system of claim 16, further comprising a recycle stream from the retro-hydrofunctionalization system for recycling carbon monoxide and/or hydrogen to the isomerization hydrofunctionalization system.

26. The manufacturing system of claim 16, further comprising a metathesis purification system configured to isolate a composition comprising C_{10} linear internal olefins from the first composition prior to the isomerization hydrofunctionalization system.

27. The manufacturing system of claim 20, further comprising an isomerization hydrofunctionalization purification system configured to isolate a composition comprising functionalized alkanes from the second composition prior to the retro-hydrofunctionalization system.

28. The manufacturing system of claim 20, further comprising a metathesis purification system configured to isolate a composition comprising C_{10} linear internal olefins from the first composition prior to the isomerization hydrofunctionalization system.

29. The manufacturing system of claim 20, further comprising a recycle stream from the retro-hydrofunctionalization system for recycling carbon monoxide and/or hydrogen to the isomerization hydrofunctionalization system.

30. The manufacturing system of claim 20, wherein the catalyst system or catalyst system components comprise a heteroatomic ligand chromium compound complex and an alkylaluminum compound, or a heteroatomic ligand, a chromium compound, and an alkylaluminum compound.