C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present are each independently H, $C_{1-30}$ alkyl, or $C_3$ to $C_{30}$ alkenyl.

**[0006b]** In another aspect, the present disclosure refers to a macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene), comprising (a) alkane repeating units have the structure -RHC-CHR- and, optionally, (b) alkene repeating units have the structure -RC=CR- or–C(=$CR_2$)-, where, (i) if -RC=CR- alkene repeating groups are present, the R of the -RC=CR- alkene repeating units are the same as the R units of at least one -RHC-CHR~~of the alkane repeating units~~, and where R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl, or,

(ii) when absent an alkene repeating unit the R of the –RHC-CHR- units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl, or,

(iii) when -RC=CR- alkene repeating units are present and the poly(alkane-co-alkene) compris~~es~~~~ing~~ exclusively one unsubstituted alkane repeating units, R of the alkane repeating units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl and R of the alkene repeating units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl, or

(iv) when a copolymer with –$H_2$C-$CH_2$- repeating units, the R of the -RC=CR-alkene repeating units or the –RHC-CHR- units independently is $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups

are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl.

**[0006c]** In yet another aspect, the present disclosure refers to a method of forming a macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene) disclosed herein comprising:

reacting a macrocyclic polyalkene and hydrogen in the presence of a hydrogenation catalyst to form the polyalkane or poly(alkane-co-alkene); and

isolating the macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene).

**[0006d]** In a further aspect, the present disclosure refers to a method of forming a macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene) disclosed herein comprising:

reacting a macrocyclic poly(cycloalkene) with an excess of an alkene and an olefin metathesis catalyst thereby forming a macrocyclic poly(alkane-co-alkene) comprising vicinal $–C(=CR_2)-$ groups; and

optionally isolating the macrocyclic polyalkane or the macrocyclic poly(alkane-co-alkene) comprising –C(=$CR_2$)- groups.

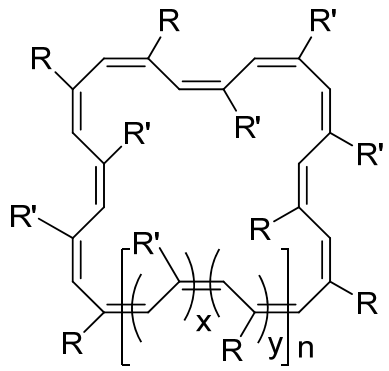
**[0007]** Provided herein are macrocyclic polyalkene copolymers that are a conjugated polyalkene having no chain ends and in the form of a macrocycle, comprising at least two different repeating units have the structure -RC=CR-. The R groups are independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl, provided that when all R are an unsubstituted $C_1$ to $C_{30}$ alkyl, at least one R is not a $C_4$, $C_6$, $C_7$, or $C_{13}$ alkyl; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkene where the alkylene portion of the cycloalkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R'

## CLAIMS

What is claimed is:

1. A conjugated macrocyclic polyalkene copolymer, comprising a fully conjugated polyalkene having no chain ends and in the form of a macrocycle, comprising at least two different repeating units have the structure -RC=CR- where R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl, provided that when all R are an unsubstituted $C_1$ to $C_{30}$ alkyl, at least one R is not a $C_4$, $C_6$, $C_7$, or $C_{13}$ alkyl; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkene where the alkylene portion of the cycloalkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present are each independently H, $C_{1\text{-}30}$ alkyl, or $C_3$ to $C_{30}$ alkenyl.

2. The macrocyclic polyalkene copolymer according to claim 1, having a structure of:




wherein R and R' in the structure are each independently an R as defined in claim 1, and each of n, x, and y is independently an integer of 1 to 100.

3. The macrocyclic polyalkene copolymer according to claim 2, wherein each of n, x, and y is independently an integer of 1 to 50.

4. The macrocyclic polyalkene copolymer according to claim 2 or 3, wherein each of n, x, and y is independently an integer of 1 to 25.

5. The macrocyclic polyalkene copolymer according to any one of claims 1 to 4, wherein at least one R is substituted $C_1$ to $C_{30}$ alkyl, substituted $C_3$ to $C_{30}$ alkenyl, which is substituted with hydroxy, $C_2$-$C_{30}$ alkoxy, $C_6$-$C_{14}$ aryloxy, $C_7$-$C_{30}$ arylalkyloxy, $C_2$-$C_{30}$ alkenyloxy, $C_2$-$C_{30}$ alkynyloxy, $C_8$-$C_{30}$ arylalkenyloxy, $C_8$-$C_{30}$ arylalkynyloxy, $CO_2H$, $C_2$-$C_{30}$ alkylester, $C_7$-$C_{15}$ arylester, $C_8$-$C_{30}$ alkylarylester, $C_3$-$C_{30}$ alkenylester, $NH_2$, $C_3$-$C_{30}$ alkylamino, $C_6$-$C_{14}$ arylamino, $C_7$-$C_{30}$ (arylalkyl)amino, $C_3$-$C_{30}$ alkenylamino, $C_3$-$C_{30}$ alkynylamino, $C_8$-$C_{30}$ (arylalkenyl)amino, $C_8$-$C_{30}$ (arylalkynyl)amino,$C_3$-$C_{30}$ dialkylamino, $C_{12}$-$C_{28}$ diarylamino, $C_4$-$C_{30}$ dialkenylamino, $C_4$-$C_{30}$ dialkynylamino, $C_7$-$C_{30}$ aryl(alkyl)amino, $C_7$-$C_{30}$ di(arylalkyl)amino, $C_8$-$C_{30}$ alkyl(arylalkyl)amino, $C_{15}$-$C_{30}$ aryl(arylalkyl)amino, $C_8$-$C_{30}$ alkenyl(aryl)amino, $C_8$-$C_{30}$ alkynyl(aryl)amino, $C(O)NH_2$, $C_2$-$C_{30}$ alkylamido, $C_7$-$C_{14}$ arylamido, $C_8$-$C_{30}$ (arylalkyl)amido, $C_2$-$C_{30}$ dialkylamido, $C_{12}$-$C_{28}$ diarylamido, $C_8$-$C_{30}$ aryl(alkyl)amido, $C_{15}$-$C_{30}$ di(arylalkyl)amido, $C_9$-$C_{30}$ alkyl(arylalkyl)amido, $C_{16}$-$C_{30}$ aryl(arylalkyl)amido, thiol, $C_2$-$C_{30}$ hydroxyalkyl, $C_6$-$C_{14}$ hydroxyaryl, $C_7$-$C_{30}$ hydroxyarylalkyl, $C_3$-$C_{30}$ hydroxyalkenyl, $C_3$-$C_{30}$ hydroxyalkynyl, $C_8$-$C_{30}$ hydroxyarylalkenyl, $C_8$-$C_{30}$ hydroxyarylalkynyl, $C_3$-$C_{30}$ polyether, $C_3$-$C_{30}$ polyetherester, $C_3$-$C_{30}$ polyester, $C_3$-$C_{30}$ polyamino, $C_3$-$C_{30}$ polyaminoamido, $C_3$-$C_{30}$ polyaminoether, $C_3$-$C_{30}$ polyaminoester, or $C_3$-$C_{30}$ polyamidoester.

6. The macrocyclic polyalkene copolymer according to any one of claims 1 to 4, wherein each R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl; or a substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl.

7. The macrocyclic polyalkene copolymer according to any one of claims 1 to 4, wherein each R is independently H or a substituted or unsubstituted $C_{1\text{-}3}$, $C_5$, $C_{8\text{-}12}$, or $C_{14\text{-}30}$ alkyl.

8. A macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene), comprising:

(a) alkane repeating units have the structure -RHC-CHR- and,

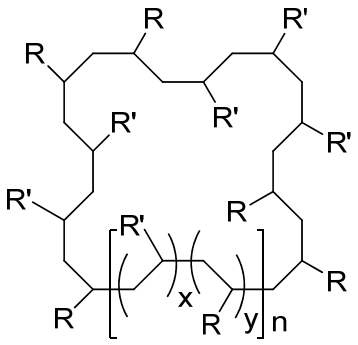
optionally, (b) alkene repeating units have the structure -RC=CR- or–C(=$CR_2$)-,

where, (i) if -RC=CR- alkene repeating groups are present, the R of the -RC=CR- alkene repeating units are the same as the R units of at least one -RHC-CHR-~~of the alkane repeating units~~, and where R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl, or,

(ii) when absent an alkene repeating unit the R of the –RHC-CHR- units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl, or,

(iii) when -RC=CR- alkene repeating units are present and the poly(alkane-co-alkene) comprises~~ing~~ exclusively one unsubstituted alkane repeating units, R of the alkane repeating units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl and R of the alkene repeating units is independently $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl, or

(iv) when a copolymer with –$H_2C$-$CH_2$- repeating units, the R of the -RC=CR- alkene repeating units or the –RHC-CHR- units independently is $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$; substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a $C_8$-$C_{30}$ cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR', C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, $C_{1-30}$ alkyl, $C_3$ to $C_{30}$ alkenyl.

9. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 8, having a structure of , wherein R and R' in the structure are each independently C1-3, C5, C8-12, or C14-30; substituted or unsubstituted C3 to C30 alkenyl having one or more alkene bonds where a plurality of alkene bonds can be non-conjugated, conjugated, or a mixture thereof; or where two R groups are combined as a C8-C30 cycloalkane and/or cycloalkene where the alkylene portion of the cycloalkane and/or alkene is substituted or unsubstituted and/or interrupted one or more times with O, NR", C(O), C(O)O, and/or C(O)NR", where R' and/or R", when present, are each independently H, C1-30 alkyl, C3 to C30 alkenyl,~~an R as defined in claim 8~~, and each of n, x, and y is an integer of 1 to 100.

10. The macrocyclic polyalkene copolymer according to claim 9, wherein each of n, x, and y is independently an integer of 1 to 50.

11. The macrocyclic polyalkene copolymer according to claim 9 or 10, wherein each of n, x, and y is independently an integer of 1 to 25.

12. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein at least one R is substituted $C_1$ to $C_{30}$ alkyl, or substituted $C_3$ to $C_{30}$ alkenyl, which is substituted singularly or plurally and each substitution is independently hydroxy, $C_2$-$C_{30}$ alkoxy, $C_6$-$C_{14}$ aryloxy, $C_7$-$C_{30}$ arylalkyloxy, $C_2$-$C_{30}$ alkenyloxy, $C_2$-$C_{30}$ alkynyloxy, $C_8$-$C_{30}$ arylalkenyloxy, $C_8$-$C_{30}$ arylalkynyloxy, $CO_2H$, $C_2$-$C_{30}$ alkylester, $C_7$-$C_{15}$ arylester, $C_8$-$C_{30}$ alkylarylester, $C_3$-$C_{30}$ alkenylester, $NH_2$, $C_3$-$C_{30}$ alkylamino, $C_6$-$C_{14}$ arylamino, $C_7$-$C_{30}$ (arylalkyl)amino, $C_3$-$C_{30}$ alkenylamino, $C_3$-$C_{30}$ alkynylamino, $C_8$-$C_{30}$ (arylalkenyl)amino, $C_8$-$C_{30}$ (arylalkynyl)amino,$C_3$-$C_{30}$ dialkylamino, $C_{12}$-$C_{28}$ diarylamino, $C_4$-$C_{30}$ dialkenylamino, $C_4$-$C_{30}$ dialkynylamino, $C_7$-$C_{30}$ aryl(alkyl)amino, $C_7$-$C_{30}$ di(arylalkyl)amino, $C_8$-$C_{30}$ alkyl(arylalkyl)amino, $C_{15}$-$C_{30}$ aryl(arylalkyl)amino, $C_8$-$C_{30}$

alkenyl(aryl)amino, $C_8$-$C_{30}$ alkynyl(aryl)amino, $C(O)NH_2$, $C_2$-$C_{30}$ alkylamido, $C_7$-$C_{14}$ arylamido, $C_8$-$C_{30}$ (arylalkyl)amido, $C_2$-$C_{30}$ dialkylamido, $C_{12}$-$C_{28}$ diarylamido, $C_8$-$C_{30}$ aryl(alkyl)amido, $C_{15}$-$C_{30}$ di(arylalkyl)amido, $C_9$-$C_{30}$ alkyl(arylalkyl)amido, $C_{16}$-$C_{30}$ aryl(arylalkyl)amido, thiol, $C_2$-$C_{30}$ hydroxyalkyl, $C_6$-$C_{14}$ hydroxyaryl, $C_7$-$C_{30}$ hydroxyarylalkyl, $C_3$-$C_{30}$ hydroxyalkenyl, $C_3$-$C_{30}$ hydroxyalkynyl, $C_8$-$C_{30}$ hydroxyarylalkenyl, $C_8$-$C_{30}$ hydroxyarylalkynyl, $C_3$-$C_{30}$ polyether, $C_3$-$C_{30}$ polyetherester, $C_3$-$C_{30}$ polyester, $C_3$-$C_{30}$ polyamino, $C_3$-$C_{30}$ polyaminoamido, $C_3$-$C_{30}$ polyaminoether, $C_3$-$C_{30}$ polyaminoester, $C_3$-$C_{30}$ polyamidoester.

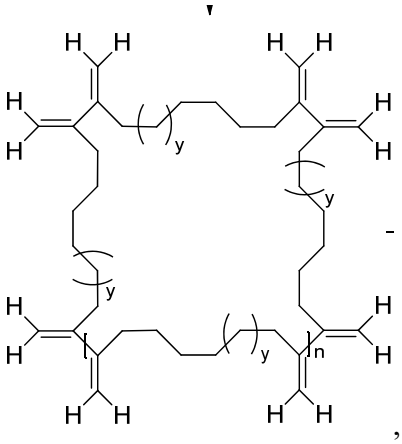
13. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein each R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl; or a substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl; provided that when all R are an unsubstituted $C_1$ to $C_{30}$ alkyl, at least one R is not a $C_4$, $C_6$, $C_7$, or $C_{13}$ alkyl.

14. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein each R is independently H or a substituted or unsubstituted $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl.

15. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein the macrocyclic polyalkane has $C_8$-$C_{30}$ cycloalkane repeating units.

16. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein the macrocyclic polyalkane is macrocyclic polypropylene.

17. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 11, wherein the macrocyclic poly(alkane-co-alkene) comprises vicinal –$C(=CR_2)$- groups.

18. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 17, having a structure , wherein the H atoms depicted in the structure can be H or another R group as defined in claim 8, and each of n and y is an integer of 1 to 100.

19. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 18, wherein each y is independently an integer of 1 to 20 and n is an integer of 1 to 50.

20. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 18 or claim 19, wherein each y is independently an integer of 1 to 10 and n is an integer of 1 to 25.

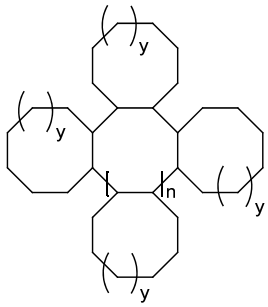
21. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 18 to 20, wherein each y is independently an integer of 1 to 5 and n is an integer of 1 to 10.

22. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 21, wherein the macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) comprises vicinal –C($CHR_2$)- groups.

23. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 18 to 22, wherein each R is independently: H; a substituted or unsubstituted $C_1$ to $C_{30}$ alkyl; or a substituted or unsubstituted $C_3$ to $C_{30}$ alkenyl.

24. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 18 to 22, wherein each R is independently H or a substituted or unsubstituted $C_{1-3}$, $C_5$, $C_{8-12}$, or $C_{14-30}$ alkyl.

25. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 18 to 22, wherein the macrocyclic polyalkane has $C_8$-$C_{30}$ cycloalkane repeating units in the polymer backbone.

26. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 25 having a structure: 

, wherein each y and n are independently integers from 1 to 100.

27. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 26, wherein each y is independently an integer of 1 to 20 and n is an integer of 1 to 50.

28. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to claim 26 or claim 27, wherein each y is independently an integer of 1 to 10 and n is an integer of 1 to 25.

29. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 26 to 28, wherein each y is independently an integer of 1 to 5 and n is an integer of 1 to 10.

30. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 24, further comprising C=C bridges between a plurality of macrocyclic poly(alkane-co-alkene)s to form a poly(macrocyclic poly(alkane-co-alkene)).

31. The macrocyclic polyalkane or macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 24, further comprising one or more C=C bridges between alkene repeating units of the macrocyclic poly(alkane-co-alkene)s, in the form of bi-macrocyclic, tri-macrocyclic and/or multi-macrocyclic poly(alkane-co-alkene)s.

32. A method of forming a macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene) according to any one of claims 8 to 31 comprising:

reacting a macrocyclic polyalkene and hydrogen in the presence of a hydrogenation catalyst to form the polyalkane or poly(alkane-co-alkene); and

isolating the macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene).

33. The method of claim 32, wherein the hydrogen is provided in an amount of at least a molar equivalent of the macrocyclic polyalkene, thereby forming a polyalkane.

34. The method of claim 32, wherein the hydrogen is provided in an amount of less than a molar equivalent of the macrocyclic polyalkene, thereby forming a poly(alkane-co-alkene).

35. A method of forming a macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene) according to any one of claims 17 to 24 comprising:

reacting a macrocyclic poly(cycloalkene) with an excess of an alkene and an olefin metathesis catalyst thereby forming a macrocyclic poly(alkane-co-alkene) comprising vicinal $–C(=CR_2)-$ groups; and

optionally isolating the macrocyclic polyalkane or the macrocyclic poly(alkane-co-alkene) comprising $–C(=CR_2)-$ groups.

36. The method of claim 35, further comprising:

reacting the macrocyclic poly(alkane-co-alkene) comprising vicinal $–C(=CR_2)-$ groups and hydrogen in the presence of a hydrogenation catalyst thereby forming a macrocyclic polyalkane or a macrocyclic poly(alkane-co-alkene) comprising isolated $–C(C=CR_2)$ groups; and

optionally isolating the macrocyclic polyalkane or the macrocyclic poly(alkane-co-alkene) comprising isolated $–C(=CR_2)-$ groups.

37. The method according to claim 36, further comprising:

combining the macrocyclic poly(alkane-co-alkene) comprising isolated –C(=$CR_2$)- groups with an olefin metathesis catalyst; and

condensing isolated –C(=$CR_2$)- groups to form a poly(macrocyclic poly(alkane-co-alkene)) comprising C=C links between macrocyclic poly(alkane-co-alkene) repeating units to form a poly(macrocyclic poly(alkane-co-alkene)); and

optionally isolating the poly(macrocyclic poly(alkane-co-alkene)).

38. The method according to claim 37, further comprising:

combining the poly(macrocyclic poly(alkane-co-alkene)) with hydrogen in the presence of a hydrogenation catalyst, thereby

hydrogenating the poly(macrocyclic poly(alkane-co-alkene)) to form a poly(macrocyclic poly(alkane)).

39. The method according to claim 36, further comprising:

combining a dilute solution of the macrocyclic poly(alkane-co-alkene) comprising isolated –C(=$CR_2$)- groups with an olefin metathesis catalyst; and

condensing isolated –C(=$CR_2$)- groups to form bi-macrocyclic, tri-macrocyclic and/or multi-macrocyclic poly(alkane-co-alkene)s.

40. The method according to claim 39, further comprising:

combining the bi-macrocyclic, tri-macrocyclic and/or multi-macrocyclic poly(alkane-co-alkene)s with hydrogen in the presence of a hydrogenation catalyst, thereby hydrogenating the bi-macrocyclic, tri-macrocyclic and/or multi-macrocyclic poly(alkane-co-alkene)s to form bi-macrocyclic, tri-macrocyclic and/or multi-macrocyclic poly(alkane)s.