CLAIMS

1. A solid precatalyst component for use in olefinic polymerization, the solid precatalyst component comprising:

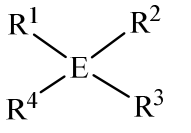
titanium;

magnesium; and

an electron donor compound;

wherein:

the electron donor compound comprising at least one compound represented by Formula (I):



(I)

wherein:

E is Si or Ge ;

when E is Si:

R^1 and R^2 are independently a moiety represented by formula IIA, IIB, IIC, or IID;

a is 0;

b is 1 or 2;

c is 0, 1, or 2;

R^5 is a C_1-C_6 alkyl, C_3-C_6 cycloalkyl, aryl or heteroaryl group, optionally interrupted or substituted by one or more functional groups selected from the group consisting of ether, ester, amide, carbonate, halogens, phosphate, sulfate, sulfide, sulfoxide, sulfone, carbamate, and a combination of any two or more thereof; and

R^3, and R^4 together with E are cyclized to form a hydrocarbyl ring structure;

when E is Ge:

R^1 and R^2 are independently a moiety represented by formula IIA, IIB, IIIA, or IIIB;

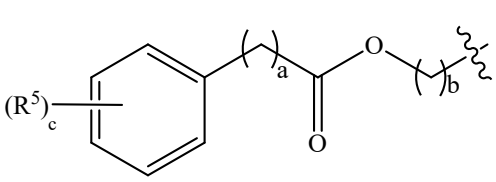
wherein when R^1 and R^2 are of formula IIA or IIB, a is 0, b is 1 or 2, and c is 0, 1, or 2,

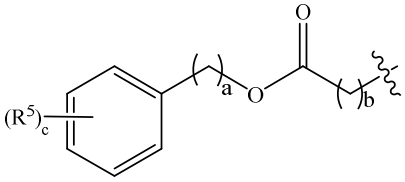
wherein when R^1 and R^2 are of formula IIIA or IIIB a is 0, 1, 2, 3, or 4, and b is 1 or 2;

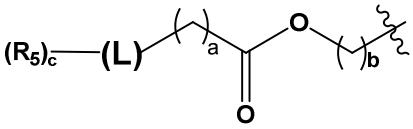
R^5 is a C_1-C_6 alkyl, C_3-C_6 cycloalkyl, aryl or heteroaryl group, optionally interrupted or substituted by one or more functional groups selected from the group consisting of ether, ester, amide, carbonate, halogens, phosphate, sulfate, sulfide, sulfoxide, sulfone, carbamate, and a combination of any two or more thereof; and

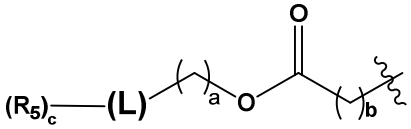
R^3 and R^4 are independently alkyl, aryl, or heteroaryl; and

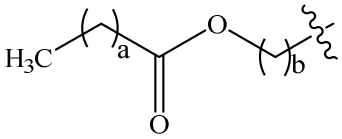
formula IIA, IIB, IIC, IID, IIIA, and IIIB are:

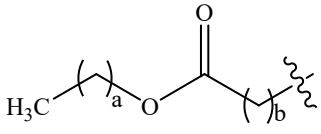

(IIA),


(IIB),


(IIC),


(IID),


(IIIA), or


(IIIB);

wherein:

L comprises a heteroaryl group.

2. The solid precatalyst component of Claim 1, wherein:

E is Si;

R^1 and R^2 are independently a moiety represented by formula IIA, IIB, IIC, or IID;

a is 0,

b is 1 or 2;

c is 0, 1 or 2;

R^5 is a C_1-C_6 alkyl, C_3-C_6 cycloalkyl, C_4-C_6 aryl, or C_4-C_6 heteroaryl group, optionally interrupted or substituted by one or more functional groups selected from the group consisting of ether, ester, amide, carbonate, halogens, phosphate, sulfate, sulfide, sulfoxide, sulfone, carbamate, and a combination of any two or more thereof; and

R^3 and R^4 together with E are cyclized to form a hydrocarbyl ring structure.

3. The solid precatalyst component of Claim 1, wherein:

E is Ge;

R^1 and R^2 are independently a moiety represented by formula IIIA or IIIB;

a is 0, 1, 2, 3, or 4;

b is 1 or 2;

c is 0, 1 or 2; and

R^3 and R^4 are independently C_1-C_{20} alkyl, C_4-C_6 aryl, or C_4-C_6 heteroaryl.

4. The solid precatalyst component of Claim 1, wherein: R^1 and R^2 are the same.

5. The solid precatalyst component of Claim 1, wherein: R^3 and R^4 are the same.

6. The solid precatalyst component of Claim 1, wherein the compound represented by Formula (I) comprises:

silolane-1,1-diylbis(methylene) dibenzoate;

silinane-1,1-diylbis(methylene) bis(4-methylbenzoate);

silinane-1,1-diylbis(methylene) dibenzoate;

(diphenylgermanediyl)bis(methylene) dibenzoate;

(diphenylgermanediyl)bis(methylene) bis(4-methylbenzoate);

dibutyl 2,2'-(diphenylgermanediyl)diacetate;

(dibutylgermanediyl)bis(methylene) dibenzoate;

siletane-1,1-diylbis(methylene) dibenzoate; or

silinane-1,1-diylbis(methylene) bis(furan-2-carboxylate).

7. The solid precatalyst component of Claim 1, wherein the titanium comprises a titanium compound having at least one titanium-halogen bond and the electron donor compound is supported on a magnesium halide crystal lattice.

8. The solid precatalyst component of Claim 1, wherein the titanium comprises $TiCl_4$.

9. A catalyst system for use in olefinic polymerization, the catalyst system comprising:

the pre catalyst component of Claim 1; and

an organoaluminum compound represented by general formula (XII):

$$AlR_nX_{3-n} \qquad \text{(XII)},$$

wherein

R independently represents a hydrocarbon group usually having 1 to about 20 carbon atoms, X represents a halogen atoms, and n is greater than 0, up to, and including, 3;

and optionally, further comprising an organosilicon compound represented by the formula (XIII):

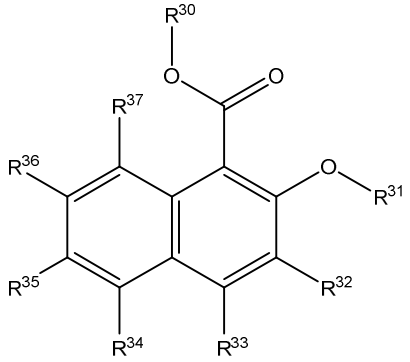
$$R_nSi(OR')_{4-n} \quad \text{(XIII)}$$

wherein

each R and R' independently represent a hydrocarbon group, and n is from 0 to less than 4.

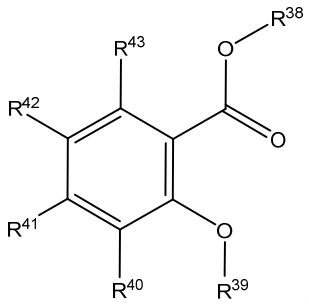
10. The catalyst system of Claim 9 further comprising at least one additional electron donor compound selected from the group consisting of:

a compound represented by general formula (IV):



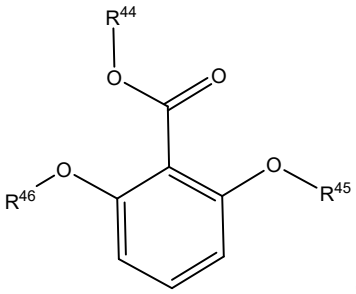
(IV);

a compound represented by general formula (V):



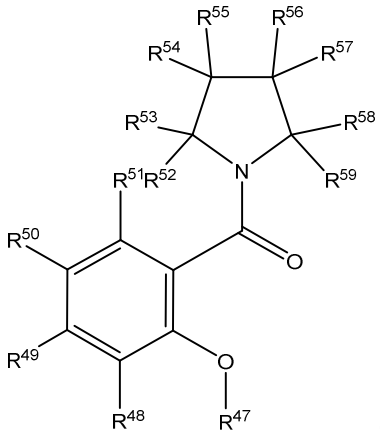
(V);

a compound represented by general formula (VI):



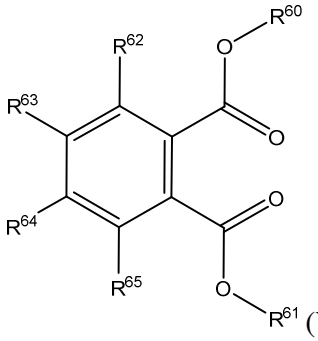
(VI);

a compound represented by general formula (VII):



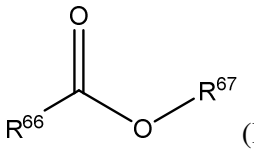
(VII);

a compound represented by general formula (VIII):



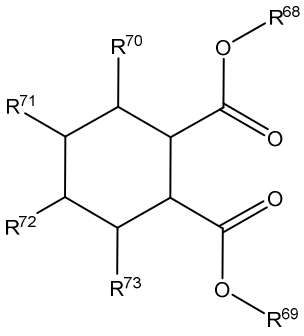
(VIII);

a compound represented by general formula (IX):



(IX);

a compound represented by general formula (X):



(X); and

combinations thereof, wherein

R^{30} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cycylic or arcyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a –O-, -NH-, or –S- group in place of a $–CH_2-$ group or a –N= group in place of a –C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{31} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{32}, R^{33}, R^{34}, R^{35}, R^{36}, and R^{37} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $–CH_2-$ group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{38} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22}

hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $–CH_2$- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{39} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{40}, R^{41}, R^{42}, and R^{43} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{44}, R^{45}, and R^{46} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $–CH_2$- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{47} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $–CH_2$- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{48}, R^{49}, R^{50}, and R^{51} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place

of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{52}, R^{53}, R^{54}, R^{55}, R^{56}, R^{57}, R^{58}, and R^{59} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{60} and R^{61} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{62}, R^{63}, R^{64}, and R^{65} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{66} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{67} is selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a -CH_2- group or a -N= group in

place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens;

R^{68} and R^{69} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $–CH_2$- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens; and

R^{70}, R^{71}, R^{72}, and R^{73} are each independently selected from the group consisting of a hydrogen; a halogen; and a linear or branched, cyclic or acyclic, saturated or non-saturated C_1 to C_{22} hydrocarbyl group, wherein the hydrocarbyl group optionally contains a -O-, -NH-, or -S- group in place of a $-CH_2$- group or a -N= group in place of a -C= group, and wherein the hydrocarbyl group is optionally substituted by one or more halogens.

11. A process of polymerizing or copolymerizing one or more olefin monomers, the process comprising:

contacting the one or more olefin monomers with the catalyst system of Claim 9 to form a polymer or a copolymer.

12. The solid precatalyst component of Claim 1, wherein:

E is Ge; and

R^1 and R^2 are independently a moiety represented by formula IIIA or IIIB.