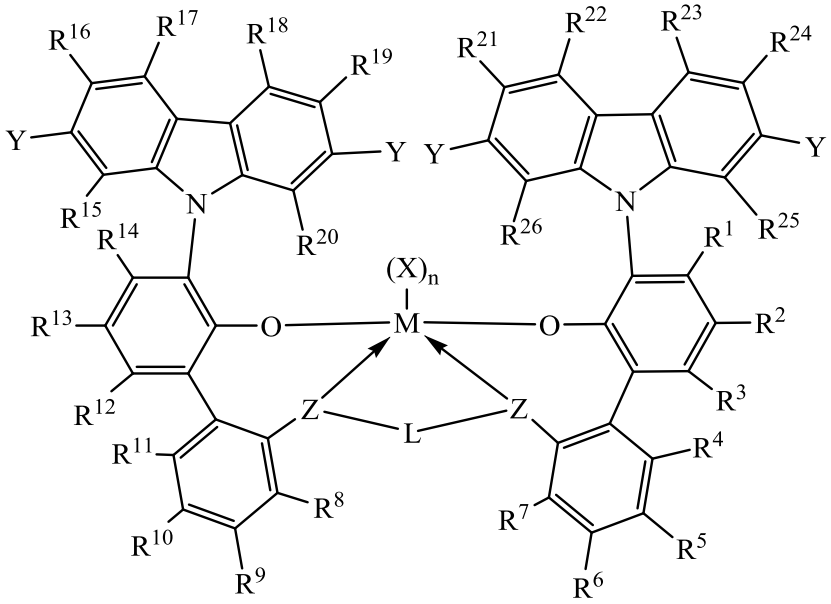
We Claim:

1. A polymerization process for producing ethylene based polymers comprising polymerizing ethylene and optionally one or more α-olefins in the presence of a catalyst system in a reactor system having one or more reactors, wherein the catalyst system comprises;

one or more procatalysts comprising a metal-ligand complex of formula (I) below:



(I)

wherein:

M is titanium, zirconium, or hafnium, each independently being in a formal oxidation state of +2, +3, or +4; and n is an integer of from 0 to 3, and wherein when n is 0, X is absent; and

each X independently is a monodentate ligand that is neutral, monoanionic, or dianionic; or two Xs are taken together to form a bidentate ligand that is neutral, monoanionic, or dianionic; and X and n are chosen in such a way that the metal-ligand complex of formula (I) is, overall, neutral; and

each Z independently is O, S, N(C_1-C_{40})hydrocarbyl, or P(C_1-C_{40})hydrocarbyl; and

L is (C_2-C_{40})hydrocarbylene or (C_2-C_{40})heterohydrocarbylene, wherein the (C_2-C_{40})hydrocarbylene has a portion that comprises a 2-carbon atom to 10-carbon atom linker backbone linking the Z atoms in formula (I) (to which L is bonded) and the

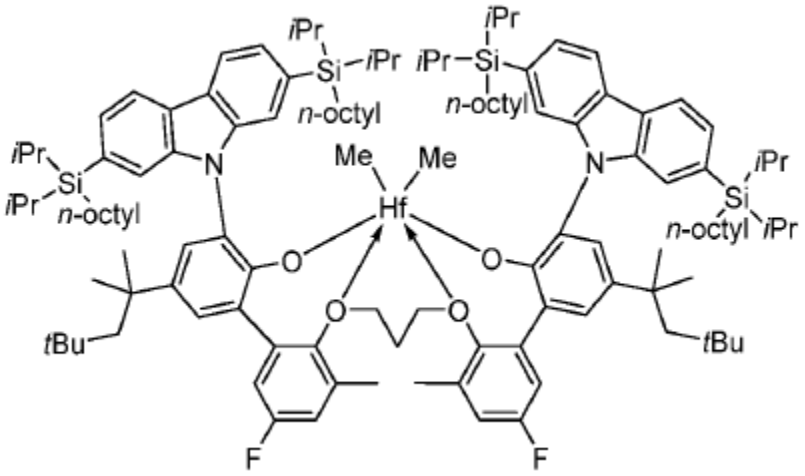
(C_2-C_{40})heterohydrocarbylene has a portion that comprises a 2-atom to 10-atom linker backbone linking the Z atoms in formula (I), wherein each of the 2 to 10 atoms of the 2-atom to 10-atom linker backbone of the (C_2-C_{40})heterohydrocarbylene independently is a carbon atom or heteroatom, wherein each heteroatom independently is O, S, S(O), $S(O)_2$, $Si(R^C)_2$, $P(R^P)$, or $N(R^N)$, wherein independently each R^C is (C_1-C_{30})hydrocarbyl, each R^P is (C_1-C_{30})hydrocarbyl; and each R^N is (C_1-C_{30})hydrocarbyl or absent; and

$R^{1\text{-}26}$ are each independently selected from the group consisting of a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C$=N-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$-, halogen atom, hydrogen atom, and any combination thereof, each of hydrocarbyl, heterohydrocarbyl, $Si(R^C)_3$, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C$=N-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, (RC)2NC(O)-, hydrocarbylene, and heterohydrocarbylene groups independently is unsubstituted or substituted with one or more R^S substituents, each R^S independently is a halogen atom, polyfluoro substitution, perfluoro substitution, unsubstituted (C1-C18)alkyl, F_3C-, FCH_2O-, F_2HCO-, F_3CO-, R_3Si-, R_3Ge-, RO-, RS-, RS(O)-, $RS(O)_2$-, R2P-, R_2N-, R_2C=N-, NC-, RC(O)O-, ROC(O)-, RC(O)N(R)-, or $R_2NC(O)$-, or two of the R^S are taken together to form an unsubstituted (C_1-C_{18})alkylene, wherein each R independently is an unsubstituted (C1-C18)alkyl;

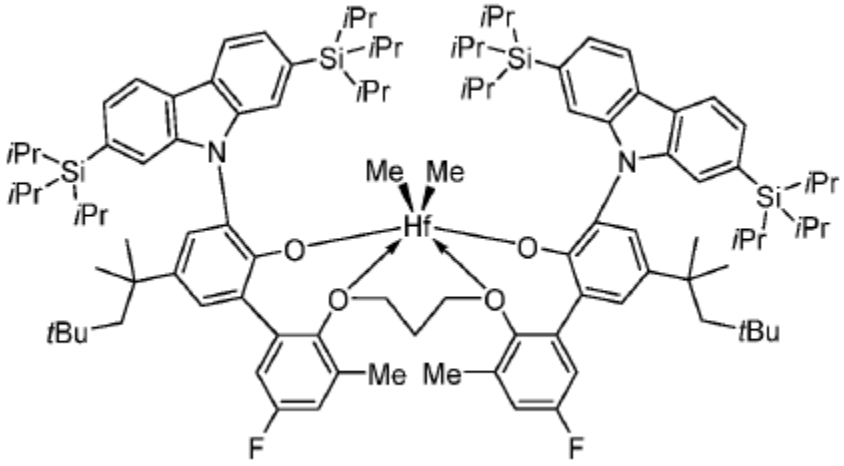
when R^7 is H, R^8 is a (C_1-C_{40})hydrocarbyl; (C_1-C_{40})heterohydrocarbyl; Si(R^C)3, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C$=N-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$- or halogen atom; or when R^8 is H, then R^7 is a (C_1-C_{40})hydrocarbyl; (C_1-C_{40})heterohydrocarbyl; $Si(R^C)_3$, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C$=N-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$- or halogen atom;

optionally two or more R groups of the $R^{1\text{-}26}$ groups (for example, from $R^{1\text{-}7}$, $R^{8\text{-}14}$, $R^{8\text{-}11}$, $R^{1\text{-}3}$, $R^{4\text{-}7}$, $R^{15\text{-}20,}$ $R^{21\text{-}26}$) can combine together into ring structures with such ring structures having from 3 to 50 atoms in the ring excluding any hydrogen atoms; and

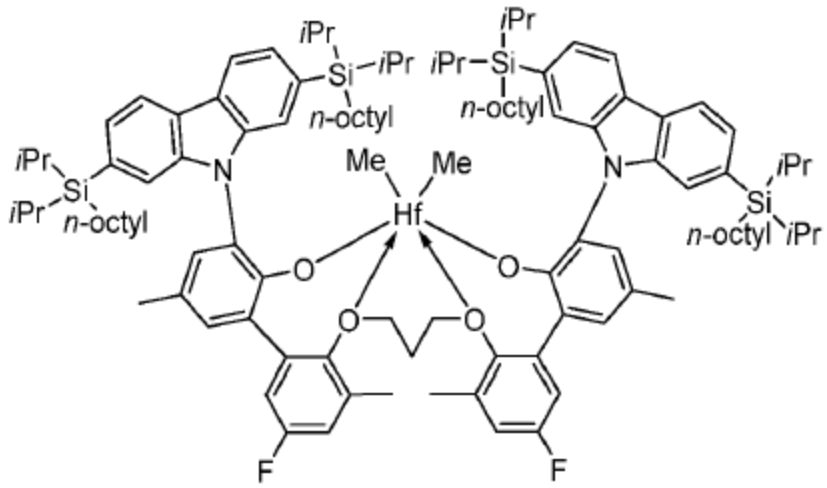
Y has the formula $-T(R^d)_b$ and contains more than four non-hydrogen atoms, wherein T is, independently for each Y occurrence, selected from the group consisting of C, Si, Ge, N, O, S, P or a combination thereof and wherein T is substituted with R^d substituents, b being an integer from 1 to 3, depending on the valency of T and R^d, each R^d is a substituent and is selected from the group consisting of hydrogen, $(C_1\text{-}C_{40})$hydrocarbyl; $(C_1\text{-}C_{40})$heterohydrocarbyl; $Si(R^C)_3$, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C{=}N$-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$-, halogen atoms, and any combination thereof provided that when T is Si, the one or more procatalysts either comprises a metal-ligand complex of formula (I) selected from the group consisting of



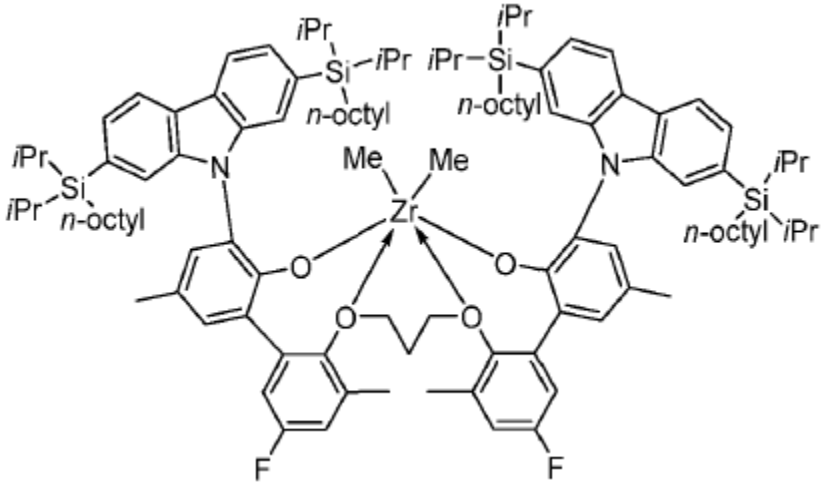
wherein Me is a methyl group and *t*Bu is a *tert*-butyl group,



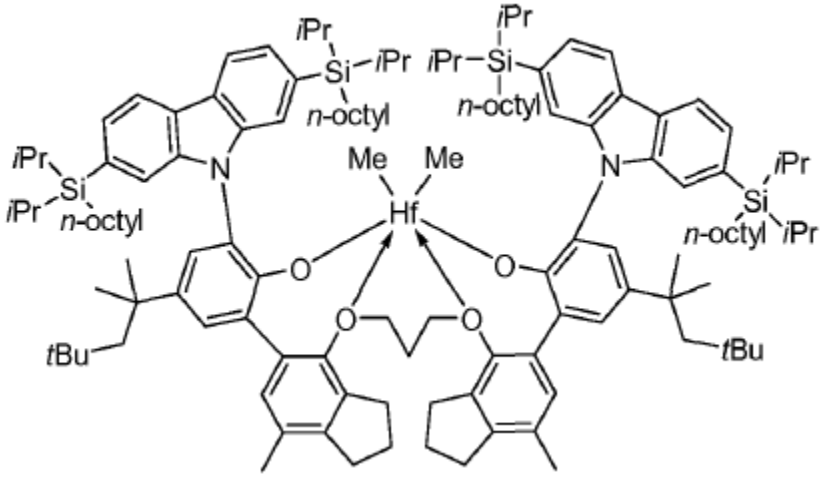
wherein Me is a methyl group, *i*Pr is an *iso*-propyl group and *t*Bu is a *tert*-butyl group,



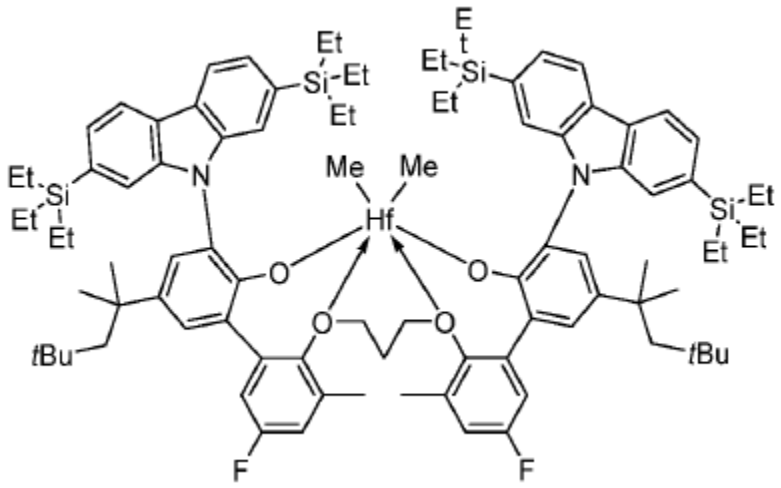
wherein Me is a methyl group, *i*Pr is an *iso*-propyl group,



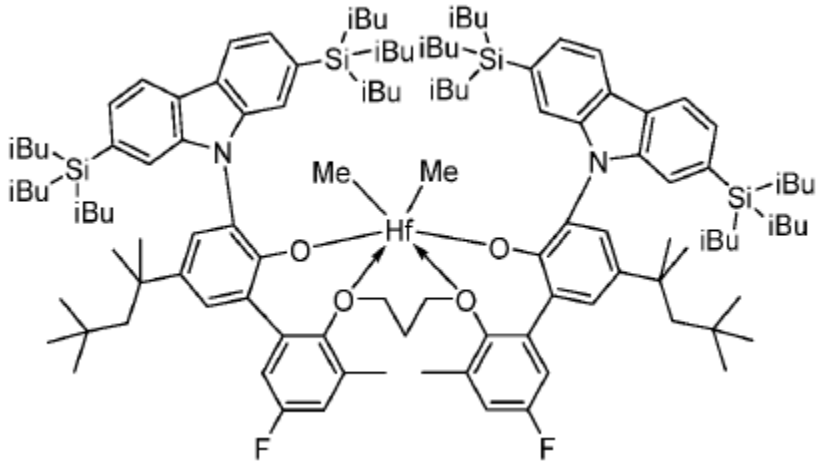
wherein Me is methyl group, iPr is an *iso*-propyl group,



wherein Me is methyl group, *i*Pr is an *iso*-propyl group and *t*Bu is a *tert*-butyl group,



wherein Me is a methyl group, Et is an ethyl group and *t*Bu is a *tert*-butyl group,



wherein Me is a methyl group, Et is an ethyl group and *t*Bu is a *tert*-butyl group; or each R^d is a substituent and is selected from the group consisting of (C_1-C_{40}) heterohydrocarbyl; $Si(R^C)_3$, $G_e(R^C)_3$, $P(R^P)_2$, $N(R^N)$, OR^C, SR^C, NO_2, CN, CF_3, $(R^C)_2C{=}N$-, $R^CC(O)O$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$-, or halogen atoms.

2. The process according to claim 1, wherein each Y has the same structure.

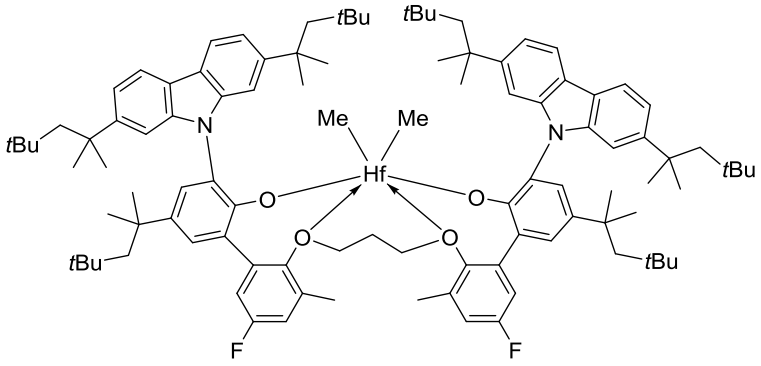
3. The process according to any one of the preceding claims, wherein T is a carbon atom.

4. The process according to any one of claims 1-2, wherein T is a silicon atom.

5. The process according to claim 1, wherein two or more R^d groups combine into a ring structure.

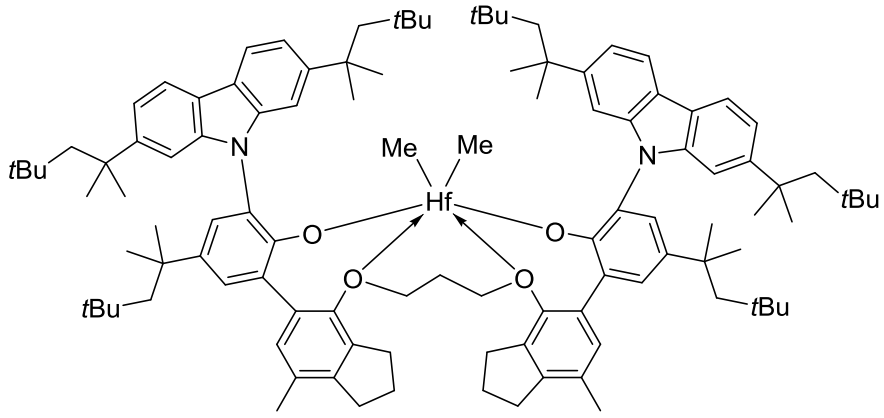
6. The process according to any one of the preceding claims, wherein each of R^7 and R^8 are a $(C_1\text{-}C_{40})$hydrocarbyl; $(C_1\text{-}C_{40})$heterohydrocarbyl; $Si(R^C)_3$, $Ge(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$-, $R^CS(O)_2$-, $(R^C)_2C$=N-, $R^CC(O)O$-, $R^COC(O)$-, $R^CC(O)N(R)$-, $(R^C)_2NC(O)$- or halogen atom.

7. The process according to claim 1, wherein the one or more procatalysts comprises a metal-ligand complex of formula (II) below



(II), wherein Me is a methyl group and *t*Bu is a *tert*-butyl group.

8. The process according to claim 1, wherein the one or more procatalysts comprises a metal-ligand complex of formula (III) below



(III), wherein Me is a methyl group and *t*Bu is a *tert*-butyl group.