background measurement. Then the highly viscous polyoctene samples were placed on one of the electrodes with a clean spatula and the test cell was closed. The excess polyoctene was pushed out of the electrodes into adjacent channels as designed. The dissipation factor of the full test cell was then measured. The test cell was then cleaned with toluene and allowed to fully dry before the next measurement. Five different polyoctene samples were provided; three made with Co-Catalyst Comparative C1, one with carborane, and one with allyl-substituted carborane. Each sample was measured at least twice in order to confirm reproducibility.

Table 2: Ethylene/Octene Co-polymers Screening

Catalyst	Amt Added (μmol)	Activator	Amt Added (μmol)	Yield (g)	Efficiency (g poly./ g metal)	Mw	Mn	PDI	Mol % Octene	Wt.% Octene
P 2	1.92	Co-Cat. 7	2.30	7.92	23,111	240,872	61,984	3.89	39.9	72.7
P 3	0.48	Co-Cat. 7	0.58	6.36	145,247	627,352	199,520	3.14	39.1	72.0
P 2	1.92	Comp C3	2.30	11.45	33,411	111,480	28,970	3.85	44.9	76.5
P 2	1.92	Comp C1	2.30	15.78	46,046	82,865	21,064	3.93	49.0	79.4
P 3	0.48	Comp C3	0.58	4.93	112,589	353,665	95,818	3.69	31.0	64.3
P 3	0.48	Comp C1	0.58	6.61	150,956	327,024	73,127	4.47	24.2	56.1

[00224] The equivalence of co-catalyst to procatalyst was 1.2.

[00225] The dissipation factor of the ethylene-octene copolymers as recorded in Table 2 were measured and the resulting spectrum is shown in FIGS. 8 and 9. FIG. 8 shows a spectrum of two comparative examples of ethylene-octene copolymer produced from Procatalyst P3 and Comparative Co-Catalysts C1 or C3 and ethylene-octene copolymer produced from Procatalyst P3 and Co-catalyst 7. The dissipation factor of the polymer produced by Co-Catalyst 7 is ten times less than the dissipation factor of the polymer produced by Comparative Co-Catalyst C1.

[00226] FIG. 9 shows a spectrum of two comparative examples of ethylene-octene copolymer produced from Procatalyst P2 and Comparative Co-Catalysts C1 or C3 and ethylene-octene copolymer produced from Procatalyst P2 and Co-catalyst 7. Similar to the dissipation factor of the polymer produced by Co-Catalyst 7 and Procatalyst P3 and shown in FIG. 8, the dissipation factor of the polymer produced by Co-Catalyst 7 and Procatalyst P2 is ten times less than the dissipation factor of the polymer produced by Procatalyst P3 and Comparative Co-Catalysts C1 and the polymer produced by Procatalyst P3 and Comparative Co-Catalysts C3.

CLAIMS

1. A polymerization process comprising:

polymerizing one or more (C_2–C_{12})α-olefin monomers in the presence of at least one catalyst and at least one co-catalyst to produce a polyolefin;

wherein the co-catalyst comprises a cation and an anion, wherein the anion has a structure having a vinyl terminated alkene, one boron atom or more than one boron atoms, and at least four halogen atoms; and

inserting the anion of the co-catalyst into a polymer chain of the polyolefin;

wherein the polyolefin comprises:

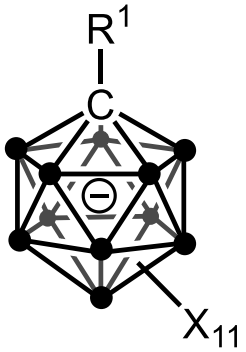
(1) greater than 0 and less than 1 mole % of the anion of the co-catalyst based on the molar composition of the polyolefin, and

(2) a density in the range from 0.853 to 0.920 g/cm^3.

2. A polymerization process comprising:

polymerizing one or more (C_2–C_{12})α-olefin monomers in the presence of at least one catalyst and at least one co-catalyst to produce a polyolefin;

wherein the co-catalyst comprises a cation and an anion, the anion has a structure according to formula (I):

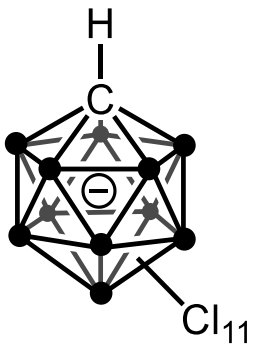


(I)

where R^1 is an unsaturated (C_2–C_{20})hydrocarbyl having a vinyl terminated alkene; and each X is independently a halogen atom; and

inserting the anion of the co-catalyst into a polymer chain of the polyolefin.

3. The process of claim 2, wherein the polyolefin has a dissipation factor less than that of a corresponding polyolefin composition produced under identical polymeric conditions except the molar amount of the anion of formula (I) is replaced by a comparative anion having the formula (Ia):



(Ia)

4. A polymerization process comprising:

copolymerizing ethylene monomer and one or more (C_3–C_{12})α-olefin monomers in the presence of at least one catalyst and at least one co-catalyst to produce a polyolefin

wherein the co-catalyst comprises a cation and an anion, the anion according to formula (II):

$^{-}BR^2R^3R^4R^5$ (II)

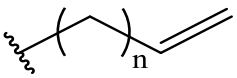
where

R^2, R^3, R^4 and R^5 is chosen from (C_1–C_{40})hydrocarbyl, wherein each (C_1–C_{40})hydrocarbyl is substituted with at least one halogen, and wherein at least one (C_1–C_{40})hydrocarbyl is substituted with a vinyl terminated alkene; and

inserting the anion of the co-catalyst into a polymer chain of the polyolefin,

wherein the polyolefin comprises less than 1 mole percent of the anion of the co-catalyst.

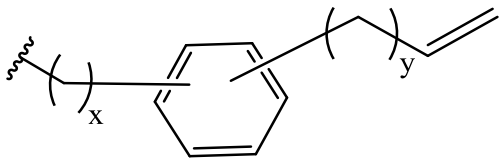
5. The polymerization process of any one of claims 1 – 3, wherein the vinyl terminated alkene has a structure according to formula (III):



(III)

where n is an integer from 1 to 10.

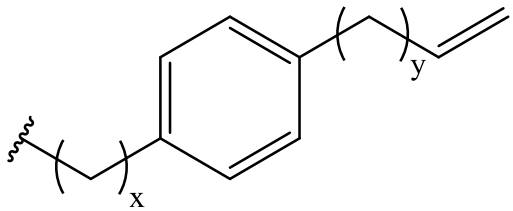
6. The polymerization process of any one of claims 1 – 3, wherein the vinyl terminated alkene has a structure according to formula (V):



(V)

where y is an integer from 1 to 10, and x is 0, 1, 2, and 3.

7. The polymerization process of claim 5, wherein the vinyl terminated alkene according to formula (V) has a structure according to formula (IV):



(IV)

where y and x are as defined in claim 5.

8. The polymerization process of any one of the preceding claims, wherein the ethylene-based polymer has a dissipation factor of less than 0.10 at a frequency of 100 Hz and a temperature of 130 °C or the ethylene-based polymer has a dissipation factor of less than 1.00 at a frequency of 10 Hz and a temperature of 130 °C.

9. The polymerization process of any one of the preceding claims, wherein the ethylene-based polymer has a dissipation factor of less than 10 at a frequency of 1.0 Hz and a temperature of 130 °C or the ethylene-based polymer has a dissipation factor of less than 100 at a frequency of 0.10 Hz and a temperature of 130 °C.

10. The polymerization process of any one of the preceding claims, wherein the cation of the co-catalyst is $^{+}N(H)R^{N}_{3}$, where each R^{N} is chosen from $(C_{1}–C_{20})$alkyl or $(C_{6}–C_{20})$aryl.

11. The polymerization process of any one of the preceding claims, wherein the cation of the co-catalyst is $^{+}N(H)R^{N}_{3}$, where at least two R^{N} are chosen from $(C_{10}–C_{20})$alkyl.

12. The polymerization process of any one of the preceding claims, wherein the cation of the co-catalyst is $^{+}C(C_{6}H_{5})_{3}$.

13. The polymerization process of any one of the preceding claims, wherein the cation of the co-catalyst is $^{+}C(C_6H_4R^C)_3$, where R^C is (C_1-C_{20})alkyl.

14. The polymerization process of any one of claims 1 to 13, wherein the polyolefin is a polyethylene, polyoctene, or an ethylene-based copolymer.

15. The polymerization process of any one of the preceding claims, wherein each X is a chlorine atom.