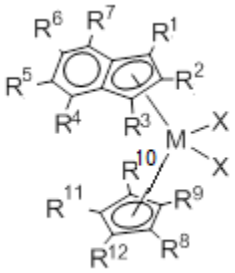


Formula I

[0010] where each of R_1 to R_{12} is independently a C_1 to C_{20} alkyl, aryl or aralkyl group, or a hydrogen, where at least one of R_4 to R_7 is not a hydrogen, where M is titanium, zirconium or hafnium, and where each X is independently a halide, C_1 to C_{20} alkyl, aralkyl or hydrogen. It is noted that any of the adjacent R-groups may combine to form a ring, as described herein.

[0010a] In one aspect, the present disclosure refers to a polymerization catalyst, the polymerization catalyst comprising a metallocene catalyst of Formula I:



(Formula I)

wherein each of R^1 to R^{12} is independently a C_1 to C_{20} alkyl, aryl or aralkyl group, a hydrogen, wherein at least one of R^4 to R^7 is not a hydrogen, wherein M is a Group 4 metal, wherein, each X is independently a halide, C_1 to C_{20} alkyl, aralkyl or hydrogen, and wherein:

R^5 and R^6 of Formula I together form a cycloalkyl group; or

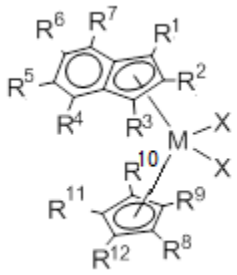
each of R^7 and R^4 of Formula I is independently a C_1 to C_{20} alkyl and each of R^1, R^2, R^3, R^5 and R^6 of Formula I is a hydrogen.

[0011] The present disclosure provides polyethylene composition comprising polyethylene formed in a single reactor via a polymerization catalyst comprising a new metallocene catalyst of the Formula I, as described above.

[0012] The present disclosure provides methods of producing polyethylene, the method comprising polymerizing ethylene in a reactor in presence of a polymerization catalyst to form the polyethylene, where the polymerization catalyst comprises a new metallocene catalyst of Formula I, as described above.

[0012a] In yet another aspect, the present disclosure refers to a method of producing polyethylene having improved ethylene enchainment, the method comprising:

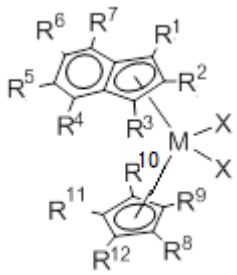
polymerizing ethylene in a reactor in presence of a polymerization catalyst to form the polyethylene, wherein the polymerization catalyst comprises a metallocene catalyst of Formula I:



(Formula I)

What is claimed:

1. A polymerization catalyst, the polymerization catalyst comprising a metallocene catalyst of Formula I:



(Formula I)

wherein each of R^1 to R^{12} is independently a C_1 to C_{20} alkyl, aryl or aralkyl group, a hydrogen, wherein at least one of R^4 to R^7 is not a hydrogen, wherein M is a Group 4 metal, wherein, each X is independently a halide, C_1 to C_{20} alkyl, aralkyl or hydrogen, and wherein:

R^5 and R^6 of Formula I together form a cycloalkyl group; or

each of R^7 and R^4 of Formula I is independently a C_1 to C_{20} alkyl and each of R^1, R^2, R^3, R^5 and R^6 of Formula I is a hydrogen.

2. The polymerization catalyst of claim 1, wherein each of R^9, R^{10}, R^{11} and R^{12} of Formula I is a hydrogen.

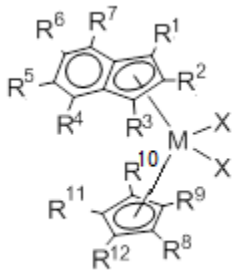
3. The polymerization catalyst of claim 1, wherein the cycloalkyl group further comprises cyclohexyl-1,1,4,4-tetramethyl.

4. The polymerization catalyst of claim 1, wherein the R^8 of Formula I is a C_1 to C_{20} alkyl; or a C_1 to C_3 alkyl.

5. The polymerization catalyst of claim 1, wherein M of Formula I further comprises titanium, zirconium or hafnium.

6. A method of producing polyethylene having improved ethylene enchainment, the method comprising:

polymerizing ethylene in a reactor in presence of a polymerization catalyst to form the polyethylene, wherein the polymerization catalyst comprises a metallocene catalyst of Formula I:



(Formula I)

wherein each of R^1 to R^{12} is independently a C_1 to C_{20} alkyl, aryl or aralkyl group, or a hydrogen, wherein at least one of R^4 to R^7 is not a hydrogen, wherein M is a Group 4 metal, wherein, each X is independently a halide, C_1 to C_{20} alkyl, aralkyl or hydrogen, and wherein:

R^5 and R^6 of Formula I together form a cycloalkyl group; or

each of R^7 and R^4 of Formula I is independently a C_1 to C_{20} alkyl and each of R^1, R^2, R^3, R^5 and R^6 of Formula I is a hydrogen.