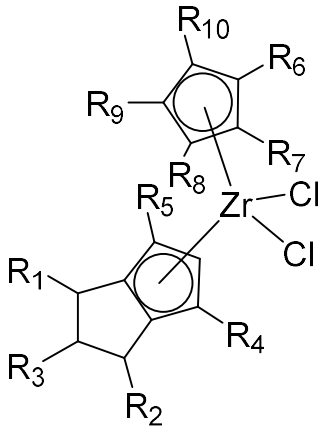
hydrogenation step. The instability or degradation could appear over a long period of time as discoloration and/or a change in molecular weight distribution of the polyolefin, or some other manifestation thereof.

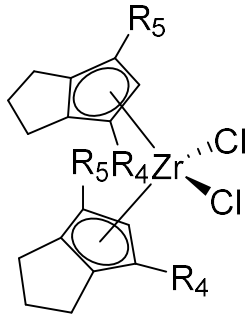
[0008] The inventive method is applied to tetrahydropentalenyl systems and comprises synthesizing a cyclic organic compound via reaction of an unsubstituted or substituted cyclopentene with an unsubstituted or substituted acrylic acid in the presence of phosphoric and/or sulfonic acid reagent to make the cyclic organic compound. Also, a method of synthesizing a ligand for a transition metal, and a related substituted ligand-metal complex and catalyst, from the unsubstituted or substituted cyclopentene and unsubstituted or substituted acrylic acid. Also, the cyclic organic compound, ligand, and substituted ligand-metal complex and catalyst synthesized thereby. Also a method of polymerizing an olefin with the catalyst to give a polyolefin, and the polyolefin made thereby.

[0008a] In one aspect, there is provided a compound of formula (8):



(8), selected from the group consisting of compounds (8a), (8-1), (8-2), (8-3), and (8-4):

compound (8a):



(8a), wherein R4 and R5 are independently as H or (C2- C4)alkyl;

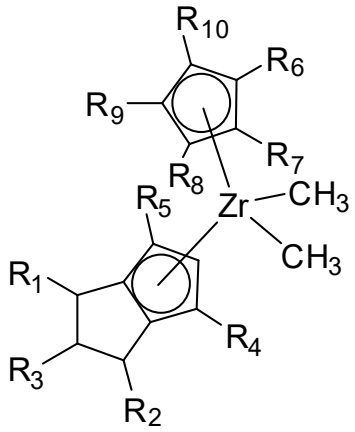
compound (8-1): compound (8) wherein R1 to R3 and R6 to R10 are H and R4 and R5 are methyl;

compound (8-2): compound (8) wherein R1 to R3 and R6 to R9 are H and R10, R4, and R5 are methyl;

compound (8-3): compound (8) wherein R1 to R3 and R6 to R9 are H, R10 is propyl, and R4 and R5 are methyl; and

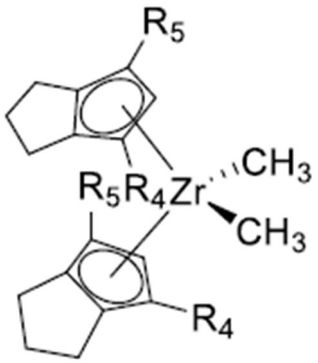
compound (8-4): compound (8) wherein R1 to R3 and R6 are H, and R7 to R10, R4 and R5 are methyl.

[0008b] In another aspect, there is provided a compound of formula (9):



(9), selected from the group consisting of compounds (9a), (9-1), (9-2), (9-3), and (9-4):

compound (9a):



(9a), wherein R4 and R5 are independently as H or (C2-C4)alkyl;

compound (9-1): compound (9) wherein R1 to R3 and R6 to R10 are H and R4 and R5 are methyl;

compound (9-2): compound (9) wherein R1 to R3 and R6 to R9 are H and R10, R4, and R5 are methyl;

compound (9-3): compound (9) wherein R1 to R3 and R6 to R9 are H, R10 is propyl, and R4 and R5 are methyl; and

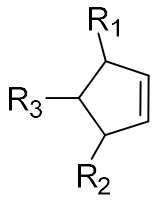
compound (9-4): compound (9) wherein R1 to R3 and R6 are H, and R7 to R10, R4 and R5 are methyl.

DETAILED DESCRIPTION

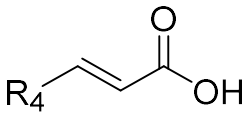
[0009] The Summary and Abstract are incorporated here by reference.

[0010] Certain inventive embodiments are described below as numbered aspects for easy cross-referencing. Additional embodiments are described elsewhere herein.

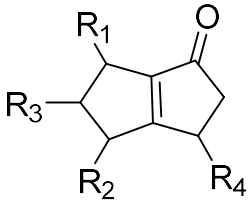
[0011] Aspect 1. A method of synthesizing a bicyclo[3.3.0]octene compound, the method comprising (A) contacting a compound of formula (1) ("compound (1)"):



(1), wherein R1, R2, and R3 are independently H or (C_1-C_4)alkyl, or R1 and R3 are bonded together to form a (C_1-C_4)alkylene and R2 is H or (C_1-C_4)alkyl, with a compound of formula (2) ("compound (2)"):



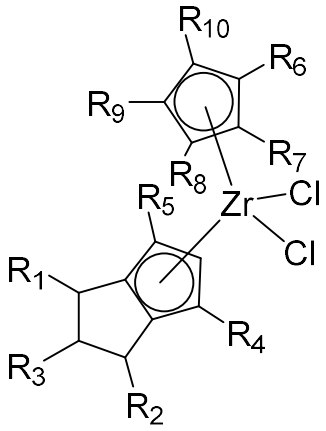
(2), wherein R4 is H or (C_1-C_4)alkyl, in the presence of an effective amount of a phosphoric and/or sulfonic acid reagent and under reaction conditions sufficient to make a compound of formula (3) ("compound (3)"):



(3) and/or its oxo/R4 regioisomer; wherein R1 to R4 are as defined above. The "/" in "oxo/R4 regioisomer" indicates the

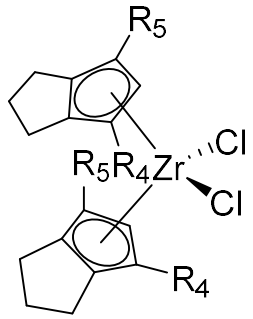
CLAIMS

1. A compound of formula (8):



(8), selected from the group consisting of compounds (8a), (8- 1), (8-2), (8-3), and (8-4):

compound (8a):



(8a), wherein R4 and R5 are independently as H or (C2- C4)alkyl;

compound (8-1): compound (8) wherein R1 to R3 and R6 to R10 are H and R4 and R5 are methyl;

compound (8-2): compound (8) wherein R1 to R3 and R6 to R9 are H and R10, R4, and R5 are methyl;

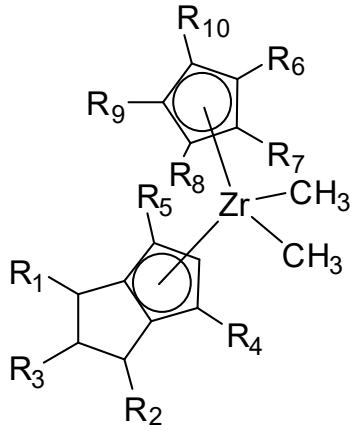
compound (8-3): compound (8) wherein R1 to R3 and R6 to R9 are H, R10 is propyl, and R4 and R5 are methyl; and

compound (8-4): compound (8) wherein R1 to R3 and R6 are H, and R7 to R10, R4 and R5 are methyl.

2. The compound of claim 1 selected from compound (8a).

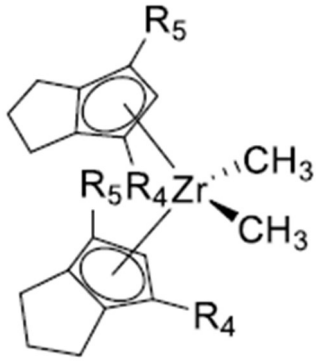
3. The compound of claim 1 selected from the group consisting of compounds (8-1), (8-2), (8-3), and (8-4).

4. A compound of formula (9):



(9), selected from the group consisting of compounds (9a), (9-1), (9-2), (9-3), and (9-4):

compound (9a):



(9a), wherein R4 and R5 are independently as H or (C2-C4)alkyl;

compound (9-1): compound (9) wherein R1 to R3 and R6 to R10 are H and R4 and R5 are methyl;

compound (9-2): compound (9) wherein R1 to R3 and R6 to R9 are H and R10, R4, and R5 are methyl;

compound (9-3): compound (9) wherein R1 to R3 and R6 to R9 are H, R10 is propyl, and R4 and R5 are methyl; and

compound (9-4): compound (9) wherein R1 to R3 and R6 are H, and R7 to R10, R4 and R5 are methyl.

5. The compound of claim 4 selected from compound (9a).

6. The compound of claim 4 selected from the group consisting of compounds (9-1), (9-2), (9-3), and (9-4).