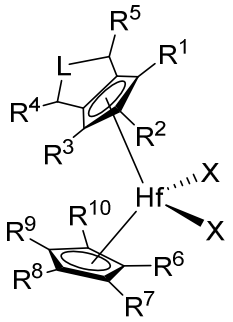
What is claimed is:

1. A bicyclic hafnium metallocene having nonidentical ligands represented by formula (I): $ABMX_2$, where: A is a bicyclic structure; and B is a cyclopentadienyl; M is hafnium; and X is a leaving group, wherein the bicyclic structure comprises a $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring and a non-aromatic cyclic structure fused with the $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring such that the bicyclic structure includes 7 to 9 ring carbon atoms and wherein subscript n is 1, 2, or 3.

2. The bicyclic hafnium metallocene having nonidentical ligands of claim 1, represented by structure (I):



where: R^1, R^2, and R^3 are each independently selected from hydrogen or a $((C_1\text{-}C_6)alkyl)$ with the proviso that at least one of R^1, R^2, and R^3 is a $((C_1\text{-}C_6)alkyl)$; R^4 and R^5 are each independently selected from hydrogen or a $((C_1\text{-}C_6)alkyl)$; L is $(C(R^{11})_2)_m$ wherein R^{11} is selected from a substituted or unsubstituted $(C_1\text{-}C_{20})$hydrocarbyl group, a substituted or unsubstituted $(C_1\text{-}C_{20})$heterohydrocarbyl group, a substituted or unsubstituted $(C_1\text{-}C_{20})$aryl group, a substituted or unsubstituted $(C_1\text{-}C_{20})$heteroaryl group, or hydrogen, and subscript m is 0, 1, or 2; R^6, R^7, R^8, R^9, and R^{10} are each independently selected from hydrogen or a $((C_1\text{-}C_6)alkyl)$.

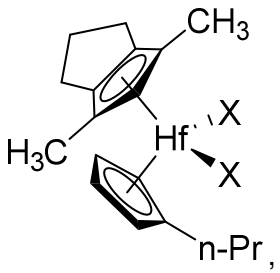
3. The bicyclic hafnium metallocene having nonidentical ligands of claim 1, wherein the non-aromatic cyclic structure is unsubstituted.

4. The bicyclic hafnium metallocene having nonidentical ligands of claim 1, wherein the cyclopentadienyl ring of the bicyclic structure is substituted with two alkyls each

having from 1 to 6 carbons and wherein the two alklys are respectively located at the 1 and 3 positions of the bicyclic structure.

5. The bicyclic hafnium metallocene having nonidentical ligands of claim 1, wherein the cyclopentadienyl of B is substituted with one alkyl having from 1 to 6 carbons.

6. The bicyclic hafnium metallocene having nonidentical ligands of claim 1, wherein the bicyclic hafnium metallocene having nonidentical ligands is represented by structure (II):



wherein X is Cl or Me.

7. A bicyclic hafnium metallocene catalyst composition comprising:

a bicyclic hafnium metallocene having nonidentical ligands represented by formula (I): $ABMX_2$, where: A is a bicyclic structure; and B is a cyclopentadienyl; M is hafnium; and X is a leaving group, wherein the bicyclic structure comprises a $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring and a non-aromatic cyclic structure fused with the $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring such that the bicyclic structure includes 7 to 9 ring carbon atoms and wherein subscript n is 1, 2, or 3; and

an activator.

8. The bicyclic hafnium metallocene catalyst composition of claim 7 further comprising a support.

9. The bicyclic hafnium metallocene catalyst composition of claim 7, wherein a molar ratio of metal in the activator to hafnium in the bicyclic hafnium metallocene having nonidentical ligands is be 1500: 1 to 0.5: 1.

10. The bicyclic hafnium metallocene catalyst composition of claim 7, wherein the composition is spray-dried.

11. A method of making a polymer, the method comprising:

contacting the bicyclic hafnium metallocene catalyst composition comprising:

a bicyclic hafnium metallocene having nonidentical ligands represented by formula (I): $ABMX_2$, where: A is a bicyclic structure; and B is a cyclopentadienyl; M is hafnium; and X is a leaving group, wherein the bicyclic structure comprises a $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring and a non-aromatic cyclic structure fused with the $((C_1\text{-}C_6)alkyl)_n$-substituted cyclopentadienyl ring such that the bicyclic structure includes 7 to 9 ring carbon atoms and wherein subscript n is 1, 2, or 3; and

an activator,

with an olefin under polymerization conditions to make the polymer.

12. The method of claim 11, wherein the polymer has a molecular weight comonomer distribution index (MWCDI) from 0.08 to 2.50.

13. The method of claim 11, wherein the bicyclic hafnium metallocene catalyst composition is supported.

14. The method of claim 11, wherein the bicyclic hafnium metallocene catalyst composition is spray-dried.

15. The method of claim 11, wherein contacting the bicyclic hafnium metallocene catalyst composition and the olefin under polymerization conditions to make the polymer occurs in a polymerization reactor.

16. The method of claim 15, wherein the polymerization reactor is a gas-phase polymerization reactor.