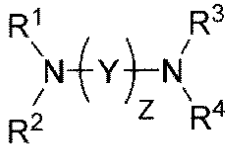
CLAIMS:

1. A method for producing an olefin oligomer, comprising performing an olefin oligomerization reaction in the presence of an olefin oligomerization catalyst containing components (A) to (C):

(A) a chromium compound,

(B) an amine compound represented by general formula (1):



(1)

wherein, in the general formula (1), R^1 to R^4 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a boron-containing group, an aluminum-containing group, a sulfur-containing group, a silicon-containing group, a germanium-containing group or a tin-containing group, and two or more thereof are optionally connected to each other,

Y represents a carbon atom having substituents R^5 and R^6 which is a structure represented by $-CR^5R^6-$, R^5 and R^6 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a boron-containing group, an aluminum-containing group, a sulfur-containing group, a phosphorus-containing group, a silicon-containing group, a germanium-containing group or a tin-containing group, and R^5 and R^6 are optionally connected to each other, and each of R^5 and R^6 are optionally connected to any one of R^1 to R^4,

Z represents an integer of 1 to 10, and

(C) at least one compound selected from the group consisting of

(C-1) an organometal compound,

(C-2) an organoaluminumoxy compound, and

(C-3) a compound reacting with a transition metal compound to form an ion pair.

2. The method for producing an olefin oligomer according to Claim 1, wherein an amine compound (B) represented by the general formula (1) is used, in which R^1 is not connected to R^3 and R^4, and R^2 is not connected to R^3 and R^4.

3. The method for producing an olefin oligomer according to Claim 1 or 2, wherein an amine compound (B) represented by the general formula (1) is used, in which Z is an integer of 1 to 3.

4. The method for producing an olefin oligomer according to any one of Claims 1 to 3, wherein an amine compound (B) represented by the general formula (1) is used, in which Z is 1.

5. The method for producing an olefin oligomer according to Claim 1 or 2, wherein an amine compound (B) represented by the general formula (1) is used, in which Z is an integer of 2 to 10.

6. The method for producing an olefin oligomer according to any one of Claims 1 to 5, wherein the catalyst contains component (D) in addition to the components (A) to (C):

(D) a carrier for carrying at least one compound selected from the group consisting of the components (A) to (C).

7. The method for producing an olefin oligomer according to any one of Claims 1 to 6, wherein the olefin oligomerization reaction is performed in the presence of an antistatic agent.

8. The method for producing an olefin oligomer according to any one of Claims 1 to 7, wherein the olefin is ethylene.

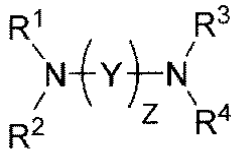
9. The method for producing an olefin oligomer according to any one of Claims 1 to 7, wherein the olefin oligomer is 1-octene.

10. The method for producing an olefin oligomer according to Claim 1, wherein the component (A) is a chromium compound containing a halogen atom.

11. An olefin oligomerization catalyst comprising components (A) and (B):

(A) a chromium compound, and

(B) an amine compound represented by general formula (1):



(1)

wherein, in the general formula (1), R^1 to R^4 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a boron-containing group, an aluminum-containing group, a sulfur-containing group, a silicon-containing group, a germanium-containing group or a tin-containing group, and two or more thereof are optionally connected to each other,

Y represents a carbon atom having substituents R^5 and R^6 which is a structure represented by $-CR^5R^6-$, R^5 and R^6 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a boron-containing group, an aluminum-containing group, a sulfur-containing group, a phosphorus-containing group, a silicon-containing group, a germanium-containing group or a tin-containing group, and R^5 and R^6 are optionally connected to each other, and each of R^5 and R^6 are optionally connected to any one of R^1 to R^4,

Z represents an integer of 1 to 10.

12. The olefin oligomerization catalyst according to Claim 11, wherein Z is 1 in the general formula (1).

13. The olefin oligomerization catalyst according to Claim 11 or 12, wherein the component (A) is a trivalent chromium compound containing a halogen atom.

14. The olefin oligomerization catalyst according to any one of Claims 11 to 13, comprising component (C) in addition to the components (A) and (B):

(C) at least one compound selected from the group consisting of

(C-1) an organometal compound,

(C-2) an organoaluminumoxy compound, and

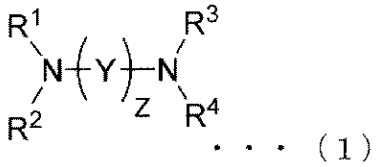
(C-3) a compound reacting with a transition metal compound to form an ion pair.

15. The olefin oligomerization catalyst according to Claim 11, wherein the component (A) is a chromium compound containing a halogen atom.

16. A method for producing an olefin oligomer, comprising performing an olefin oligomerization reaction in the presence of an olefin oligomerization catalyst containing the following components (A) to (C):

(A) a chromium compound,

(B) an amine compound represented by the following general formula (1):



・・・（1）

wherein, in the general formula (1), R^1 to R^4 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, a hydrocarbon-substituted silyl group, a hydrocarbon-substituted siloxy group, an alkoxy group, an alkylthio group, an aryloxy group, an arylthio group, an acyl group, an ester group, a thioester group, an amide group, an imide group, an amino group, an imino group, a sulfoneester group, a sulfoneamide group, a cyano group, a nitro group, a carboxyl group, a sulfo group, a mercapto group, an aluminum-containing group, or a hydroxy group, and

the hydrocarbon group is one selected from the group consisting of linear alkyl groups having 1 to 30 carbon atoms, branched alkyl groups having 1 to 30 carbon atoms, linear alkenyl groups having 2 to 30 carbon atoms, branched alkenyl groups having 2 to 30 carbon atoms, linear alkynyl groups having 2 to 30 carbon atoms, branched alkynyl groups having 2 to 30 carbon atoms, cyclic saturated hydrocarbon groups having 3 to 30 carbon atoms, cyclic unsaturated hydrocarbon groups having 5 to 30 carbon atoms, aryl groups having 6 to 30 carbon atoms, alkyl-substituted aryl groups, and alkylidene groups having 1 to 30 carbon atoms, and

two or more of R^1 to R^4 are optionally connected to each other,

Y represents a carbon atom having substituents R^5 and R^6 which is a structure represented by $-CR^5R^6-$, R^5 and R^6 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, a hydrocarbon-substituted silyl group, a hydrocarbon-substituted siloxy group, an alkoxy group, an alkylthio group, an aryloxy group, an arylthio group, an acyl group, an ester group, a thioester group, an amide group, an imide group, an amino group, an imino group, a sulfoneester group, a sulfoneamide group, a cyano group, a nitro group, a carboxyl group, a sulfo group, a mercapto group, an aluminum-containing group, or a hydroxy group, and

the hydrocarbon group is one selected from the group consisting of linear alkyl groups having 1 to 30 carbon atoms, branched alkyl groups having 1 to 30 carbon atoms, linear alkenyl groups having 2 to 30 carbon atoms, branched alkenyl groups having 2 to 30 carbon atoms, linear alkynyl groups having 2 to 30 carbon atoms, branched alkynyl groups having 2 to 30 carbon atoms, cyclic saturated hydrocarbon groups having 3 to 30 carbon atoms, cyclic unsaturated hydrocarbon groups having 5 to 30 carbon atoms, aryl groups having 6 to 30 carbon atoms, alkyl-substituted aryl groups, and alkylidene groups having 1 to 30 carbon atoms, and

R^5 and R^6 are optionally connected to each other, and each of R^5 and R^6 are optionally connected to any one of R^1 to R^4,

Z represents an integer of 1 to 10, and

(C) at least one compound selected from the group consisting of

(C-1) an organometal compound,

(C-2) an organoaluminumoxy compound, and

(C-3) a compound reacting with a transition metal compound to form an ion pair.

17. The method for producing an olefin oligomer according to Claim 16, wherein the heterocyclic compound residue is one selected from the group consisting of nitrogen-containing compounds, oxygen-containing compounds, and sulfur-containing compounds, wherein nitrogen-containing compounds, oxygen-containing compounds and sulfur-containing compounds are optionally substituted with one or more substituents.

18. The heterocyclic compound residue according to Claim 17, wherein the nitrogen-containing compound is selected from the group consisting of pyrrole, pyridine, pyrimidine, quinoline, and triazine.

19. The heterocyclic compound residue according to Claim 17 or 18, wherein the oxygen-containing compound is selected from the group consisting of furan and pyran.

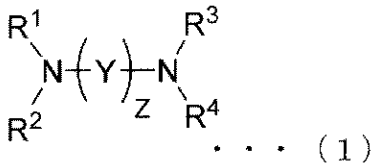
20. The heterocyclic compound residue according to any one of Claims 17 to 19, wherein the sulfur-containing compound is thiophene.

21. The heterocyclic compound residue according to any one of Claims 17 to 20, wherein each of the one or more substituents is selected from the group consisting of alkyl groups having 1 to 30 carbons and alkoxy groups having 1 to 30 carbon atoms.

22. An olefin oligomerization catalyst comprising components (A) and (B):

(A) a chromium compound, and

(B) an amine compound represented by general formula (1):



・・・（1）

wherein, in the general formula (1), R^1 to R^4 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, a hydrocarbon-substituted silyl group, a hydrocarbon-substituted siloxy group, an alkoxy group, an alkylthio group, an aryloxy group, an arylthio group, an acyl group, an ester group, a thioester group, an amide group, an imide group, an amino group, an imino group, a sulfoneester group, a sulfoneamide group, a cyano group, a nitro group, a carboxyl group, a sulfo group, a mercapto group, an aluminum-containing group, or a hydroxy group, and

the hydrocarbon group is one selected from the group consisting of linear alkyl groups having 1 to 30 carbon atoms, branched alkyl groups having 1 to 30 carbon atoms, linear alkenyl groups having 2 to 30 carbon atoms, branched alkenyl groups having 2 to 30 carbon atoms, linear alkynyl groups having 2 to 30 carbon atoms, branched alkynyl groups having 2 to 30 carbon atoms, cyclic saturated hydrocarbon groups 3 to 30 carbon atoms, cyclic unsaturated hydrocarbon groups having 5 to 30 carbon atoms, aryl groups having 6 to 30 carbon atoms, alkyl-substituted aryl groups, and alkylidene groups having 1 to 30 carbon atoms, and

two or more of R^1 to R^4 are optionally connected to each other,

Y represents a carbon atom having substituents R^5 and R^6 which is a structure represented by $-CR^5R^6-$, R^5 and R^6 are the same or different from each other, and each represents a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, a hydrocarbon-substituted silyl group, a hydrocarbon-substituted siloxy group, an alkoxy group, an alkylthio group, an aryloxy group, an arylthio group, an acyl group, an ester group, a thioester group, an amide group, an imide group, an amino group, an imino group, a sulfoneester group, a sulfoneamide group, a cyano group, a nitro group, a carboxyl group, a sulfo group, a mercapto group, an aluminum-containing group, or a hydroxy group, and

the hydrocarbon group is one selected from the group consisting of linear alkyl groups having 1 to 30 carbon atoms, branched alkyl groups having 1 to 30 carbon atoms, linear alkenyl groups having 2 to 30 carbon atoms, branched alkenyl groups having 2 to 30 carbon atoms, linear alkynyl groups having 2 to 30 carbon atoms, branched alkynyl groups having 2 to 30 carbon atoms, cyclic saturated hydrocarbon

groups having 3 to 30 carbon atoms, cyclic unsaturated hydrocarbon groups having 5 to 30 carbon atoms, aryl groups having 6 to 30 carbon atoms, alkyl-substituted aryl groups, and alkylidene groups having 1 to 30 carbon atoms, and

R^5 and R^6 are optionally connected to each other, and any of R^5 and R^6 are optionally connected to any one of R^1 to R^4,

Z represents an integer of 1 to 10.

23. The olefin oligomerization catalyst according to Claim 22, wherein the heterocyclic compound residue is one selected from the group consisting of nitrogen-containing compounds, oxygen-containing compounds, and sulfur-containing compounds, wherein nitrogen-containing compounds, oxygen-containing compounds and sulfur-containing compounds are optionally substituted with one or more substituents.

24. The heterocyclic compound residue according to Claim 23, wherein the nitrogen-containing compound is selected from the group consisting of pyrrole, pyridine, pyrimidine, quinoline, and triazine.

25. The heterocyclic compound residue according to Claim 23 or 24, wherein the oxygen-containing compound is selected from the group consisting of furan and pyran.

26. The heterocyclic compound residue according to any one of Claims 23 to 25, wherein the sulfur-containing compound is thiophene.

27. The heterocyclic compound residue according to any one of Claims 23 to 26, wherein each of the one or more substituents is selected from the group consisting of alkyl groups having 1 to 30 carbon atoms and alkoxy groups having 1 to 30 carbon atoms.

28. The method for producing an olefin oligomer according to Claim 1, wherein the heterocyclic compound residue of R^1 to R^4 and Y does not contain a nitrogen atom.

29. The olefin oligomerization catalyst according to Claim 11, wherein the heterocyclic compound residue of R^1 to R^4 and Y does not contain a nitrogen atom.