[0011]

The inventors have conducted intensive studies to achieve the object and found that use of a catalyst for olefin polymerization, which contains a bridged metallocene compound having a specific structure, enables the object to be achieved, thereby accomplishing the present disclosure.

[0012]

In particular, the present disclosure relates to the following [1] to [12].

[1] ~~In a first aspect, t~~There is provided a method for producing an olefin polymer, the method comprising polymerizing at least one olefin selected from olefins having two or more carbon atoms in the presence of a catalyst for olefin polymerization, wherein

the catalyst for olefin polymerization comprises

(A) a bridged metallocene compound represented by Formula [1] and

(B) at least one compound selected from

(b-1) an organoaluminum oxy-compound,

(b-2) a compound which reacts with the bridged metallocene compound (A) to form an ion pair, and

(b-3) an organoaluminum compound:

[0013]

groups, oxygen-containing groups, and silicon-containing groups;

Y represents a carbon atom or a silicon atom;

M represents Ti, Zr, or Hf;

Q is a structure selected from halogen atoms, hydrocarbon groups, neutral, conjugated or nonconjugated dienes having 10 or less carbon atoms, anion ligands, and neutral ligands capable of coordinating with a lone pair; j represents an integer from 1 to 4; and in the case where j represents an integer of 2 or more, multiple Qs are the same as or different from each other].

In a first aspect of the present disclosure, there is provided a method for producing an olefin polymer, the method comprising polymerizing at least one olefin selected from olefins having two or more carbon atoms in the presence of a catalyst for olefin polymerization, wherein

the catalyst for olefin polymerization comprises

(A) a bridged metallocene compound represented by Formula [1] and

(B) at least one compound selected from

(b-1) an organoaluminum oxy-compound,

(b-2) a compound which reacts with the bridged metallocene compound (A) to form an ion pair, and

(b-3) an organoaluminum compound,

wherein a solution in which the bridged metallocene compound (A) is dissolved in a hydrocarbon solvent is supplied to a polymerization system,

wherein the hydrocarbon solvent is at least one selected from butane, isobutane, cyclobutane, methylcyclopropane, pentane, isopentane, neopentane, cyclopentane, methylcyclobutane, 1,1-dimethylcyclopropane, 1,2-dimethylcyclopropane, ethylcyclopropane, hexane, 3-methylpentane, 2-methylpentane, 2,2-dimethylbutane, 2,3-dimethylbutane, cyclohexane, methylcyclopentane, 1,1-dimethylcyclobutane, 1,2-dimethylcyclobutane, 1,3-dimethylcyclobutane, ethylcyclobutane, 1,1,2-trimethylcyclopropane, 1-ethyl-1-methylcyclopropane, propylcyclopropane, isopropylcyclopropane, heptane, 2-methylhexane, 3-methylhexane, 3-ethylpentane, 2,2-dimethylpentane, 2,3-dimethylpentane, 2,4-dimethylpentane, 3,3-dimethylpentane, 2,2,3-trimethylbutane, methylcyclohexane, 1,2-dimethylpentane, 1,3-dimethylpentane, 1,2,3-trimethylbutane, cycloheptane, methylcyclohexane, 1,1-dimethylcyclopentane, 1,2-dimethylcyclopentane, 1,3-dimethylcyclopentane, ethylcyclopentane, propylcyclobutane, 1,1,2,2-tetramethylcyclopropane, 1,1,2,3-tetramethylcyclopropane, 1,1-diethylcyclopropane, 1-isopropyl-1-methylcyclopropane, 1-isopropyl-2-methylcyclopropane, 1-propyl-2-methylcyclopropane,

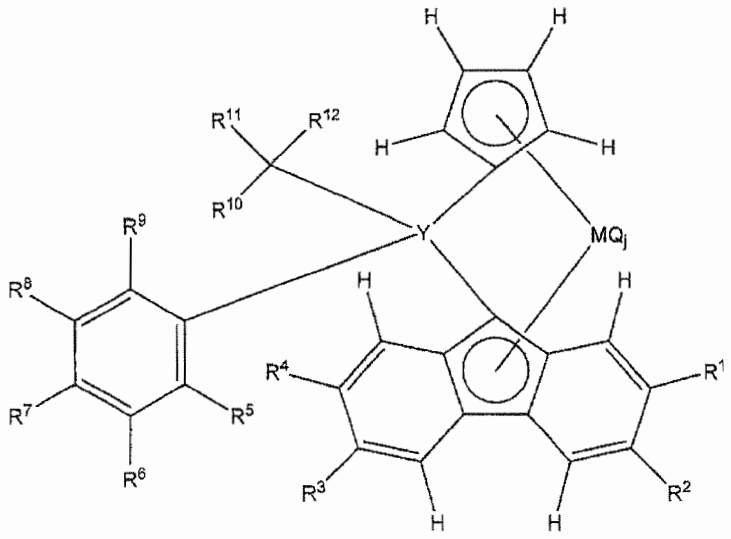
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3-ethyl-2-methylhexane, 3-ethyl-3-methylhexane, 4-ethyl-2-methylhexane, 4-ethyl-3-methylhexane, 2,2,3,3-tetramethylpentane, 2,2,3,4-tetramethylpentane, 2,2,4,4-tetramethylpentane, 2,3,3,4-tetramethylpentane, 2,2-dimethyl-3-ethylpentane, 2,2-diethylpentane, 2,3-diethylpentane, cyclononane, methylcyclooctane, ethylcycloheptane, 1,1-dimethylcycloheptane, 1,2-dimethylcycloheptane, 1,3-dimethylcycloheptane, 1,4-dimethylcycloheptane, propylcyclohexane, isopropylcyclohexane, 1-ethyl-2-methylcyclohexane, 1-ethyl-3-methylcyclohexane, 1-ethyl-4-methylcyclohexane, 1,1,2-trimethylcyclohexane, 1,1,3-trimethylcyclohexane, 1,1,4-trimethylcyclohexane, 1,2,3-trimethylcyclohexane, 1,2,4-trimethylcyclohexane, butylcyclopentane, isobutylcyclopentane, 2-cyclopentylbutane, 1,2-diethylcyclopentane, 1-isopropyl-3-methylcyclopentane, 1-methyl-2-propylcyclopentane, 2-ethyl-1,1-dimethylcyclopentane, 1,1,3,3-tetramethylcyclopentane, 1,1,3,4-tetramethylcyclopentane, 1,2,3,4-tetramethylcyclopentane, 1,1,2,3,3-pentamethylcyclobutane, 1,2-dipropylcyclopropane, 1-hexylcyclopropane, 1-pentyl-1-methylcyclopropane, 1-pentyl-2-methylcyclopropane, decane, 2-methylnonane, 3-methylnonane, 4-methylnonane, 5-methylnonane, 2,2-dimethyloctane, 2,3-dimethyloctane, 2,4-dimethyloctane, 2,5-dimethyloctane, 2,6-dimethyloctane, 2,7-dimethyloctane, 3,3-dimethyloctane, 3,4-

dimethyloctane, 3,5-dimethyloctane, 3,6-dimethyloctane, 4,4-dimethyloctane, 4,5-dimethyloctane, 3-ethyloctane, 4-ethyloctane, 2,2,3-trimethylheptane, 2,2,4-trimethylheptane, 2,2,5-trimethylheptane, 2,2,5-trimethylheptane, 2,2,6-trimethylheptane, 2,3,3-trimethylheptane, 2,3,4-trimethylheptane, 2,3,5-trimethylheptane, 2,3,6-trimethylheptane, 2,4,4-trimethylheptane, 2,4,5-trimethylheptane, 2,4,6-trimethylheptane, 2,5,5-trimethylheptane, 2-methyl-3-ethylheptane, 2-methyl-4-ethylheptane, 3-ethyl-3-methylheptane, 3-ethyl-4-methylheptane, 3-ethyl-5-methylheptane, 3-methyl-4-ethylheptane, 5-ethyl-2-methylheptane, 3,3,4-trimethylheptane, 3,3,5-trimethylheptane, 3,4,4-trimethylheptane, 3,4,5-trimethylheptane, 4-propylheptane, 4-isopropylheptane, 2,2,3,3-tetramethylhexane, 2,2,3,4-tetramethylhexane, 2,2,3,5-tetramethylhexane, 2,2,4,4-tetramethylhexane, 2,2,4,5-tetramethylhexane, 2,2,5,5-tetramethylhexane, 2,3,3,4-tetramethylhexane, 2,3,3,5-tetramethylhexane, 2,3,4,4-tetramethylhexane, 2,3,4,5-tetramethylhexane, 3,3,4,4-tetramethylhexane, 2,2-dimethyl-3-ethylhexane, 2,3-dimethyl-3-ethylhexane, 2,3-dimethyl-4-ethylhexane, 2,4-dimethyl-4-ethylhexane, 2,5-dimethyl-3-ethylhexane, 3,3-dimethyl-4-ethylhexane, 3,4-dimethyl-3-ethylhexane, 3-ethyl-2,4-dimethylhexane, 4-ethyl-2,2-dimethylhexane, 3,3-

diethylhexane, 3,4-diethylhexane, 2,2,3,3,4-pentamethylpentane, 2,2,3,4,4-pentamethylpentane, 2,2,3-trimethyl-3-ethylpentane, 2,2,4-trimethyl-3-ethylpentane, 2,3,4-trimethyl-3-ethylpentane, 2,4-dimethyl-3-isopropylpentane, 2-methyl-3-3-diethylpentane, 4-ethyl-4-methylpentane, cyclodecane, methylcyclononane, 1,5-dimethylcyclooctane, ethylcyclooctane, cycloheptane, 1,1,2,3-tetramethylcyclohexane, 1,1,3,3-tetramethylcyclohexane, 1,1,3,5-tetramethylcyclohexane, 1,1,4,4-tetramethylcyclohexane, 1,2,2,4-tetramethylcyclohexane, 1,2,3,4-tetramethylcyclohexane, 1,2,3,5-tetramethylcyclohexane, 1,2,4,5-tetramethylcyclohexane, butylcyclohexane, 1,3-diethylcyclohexane, 1,4-diethylcyclohexane, 1-ethyl-2-propylcyclohexane, 1,3-dimethyl-5-ethylcyclohexane, 1-ethyl-2,3-dimethylcyclohexane, 1-ethyl-2,4-dimethylcyclohexane, 1-isopropyl-1-methylcyclohexane, 1-isopropyl-2-methylcyclohexane, 1-isopropyl-3-methylcyclohexane, 1-isopropyl-4-methylcyclohexane, 1-methyl-2-propylcyclohexane, 1-methyl-3-propylcyclohexane, 2-ethyl-1,3-dimethylcyclohexane, sec-butylcyclohexane, tert-butylcyclohexane, isobutylcyclohexane, 1,2,3,4,5-pentamethylcyclopentane, 1,2,3-trimethyl-4-ethylcyclopentane, 1,2-dimethyl-3-isopropylcyclopentane, 1-ethyl-3-isopropylcyclopentane, 1-methyl-2,4-

diethylcyclopentane, 1-methyl-2-butylcyclopentane, 1-methyl-3-tert-butylcyclopentane, 1-methyl-3-isobutylcyclopentane, 2-isopropyl-1,3-dimethylcyclopentane, 2-cyclopentylpentane, 2-methylbutylcyclopentane, isopentylcyclopentane, pentylcyclopentane, 2-ethyl-1-methyl-3-propylcyclobutane, 1,1,2-trimethyl-3-isobutylcyclopropane, 1,1-dimethyl-2-pentylcyclopropane, 1,2-dimethyl-1-pentylcyclopropane, 1,2-dimethyl-3-pentylcyclopropane, 1-ethyl-2-pentylcyclopropane, 1-hexyl-2-methylcyclopropane, 1-methyl-2-(1-methylpentyl)cyclopropane, and 1-methyl-2-(3-methylpentyl)cyclopropane;



· · · [1]

where

R^1 to R^4 each independently represent a group selected from hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups, and two adjoining groups are

optionally bonded to each other to form a ring;

R^5 to R^9 each independently represent a group selected from a hydrogen atom, halogen atoms, hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups, and two adjoining groups are optionally bonded to each other to form a ring;

R^{10} to R^{12} each independently represent a group selected from a hydrogen atom, halogen atoms, hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups;

Y represents a carbon atom or a silicon atom;

M represents Ti, Zr, or Hf;

Q is a structure selected from halogen atoms, hydrocarbon groups, neutral, conjugated or nonconjugated dienes having 10 or less carbon atoms, anion ligands, and neutral ligands capable of coordinating with a lone pair; j represents an integer from 1 to 4; and in the case where j represents an integer of 2 or more, multiple Qs are the same as or different from each other.

[2] In the method [1] for producing an olefin polymer, R^1 and R^4 in Formula [1] are each independently a group selected from hydrocarbon groups having 1 to 40 carbon atoms and

halogen-containing hydrocarbon groups having 1 to 40 carbon atoms, and at least one of R^2 and R^3 in Formula [1] is a group selected from hydrocarbon groups having 1 to 40 carbon atoms and silicon-containing groups.

[3] In any one of the methods [1] and [2] for producing an olefin polymer, R^1 and R^4 in Formula [1] are each independently a group selected from aryl groups having 6 to 20 carbon atoms and halogen-containing aryl groups having 6 to 20 carbon atoms.

[4] In any one of the methods [1] to [3] for producing an

CLAIMS

[Claim 1]

A method for producing an olefin polymer, the method comprising polymerizing at least one olefin selected from olefins having two or more carbon atoms in the presence of a catalyst for olefin polymerization, wherein

the catalyst for olefin polymerization comprises

(A) a bridged metallocene compound represented by Formula [1] and

(B) at least one compound selected from

(b-1) an organoaluminum oxy-compound,

(b-2) a compound which reacts with the bridged metallocene compound (A) to form an ion pair, and

(b-3) an organoaluminum compound,

wherein a solution in which the bridged metallocene compound (A) is dissolved in a hydrocarbon solvent is supplied to a polymerization system,

wherein the hydrocarbon solvent is at least one selected from butane, isobutane, cyclobutane, methylcyclopropane, pentane, isopentane, neopentane, cyclopentane, methylcyclobutane, 1,1-dimethylcyclopropane, 1,2-dimethylcyclopropane, ethylcyclopropane, hexane, 3-methylpentane, 2-methylpentane, 2,2-dimethylbutane, 2,3-dimethylbutane, cyclohexane, methylcyclopentane, 1,1-dimethylcyclobutane, 1,2-

dimethylcyclobutane, 1,3-dimethylcyclobutane, ethylcyclobutane, 1,1,2-trimethylcyclopropane, 1-ethyl-1-methylcyclopropane, propylcyclopropane, isopropylcyclopropane, heptane, 2-methylhexane, 3-methylhexane, 3-ethylpentane, 2,2-dimethylpentane, 2,3-dimethylpentane, 2,4-dimethylpentane, 3,3-dimethylpentane, 2,2,3-trimethylbutane, methylcyclohexane, 1,2-dimethylpentane, 1,3-dimethylpentane, 1,2,3-trimethylbutane, cycloheptane, methylcyclohexane, 1,1-dimethylcyclopentane, 1,2-dimethylcyclopentane, 1,3-dimethylcyclopentane, ethylcyclopentane, propylcyclobutane, 1,1,2,2-tetramethylcyclopropane, 1,1,2,3-tetramethylcyclopropane, 1,1-diethylcyclopropane, 1-isopropyl-1-methylcyclopropane, 1-isopropyl-2-methylcyclopropane, 1-propyl-2-methylcyclopropane, butylcyclopropane, octane, 2-methylheptane, 3-methylheptane, 4-methylheptane, 2,2-dimethylhexane, 2,3-dimethylhexane, 2,4-dimethylhexane, 2,5-dimethylhexane, 3,3-dimethylhexane, 3,4-dimethylhexane, 3-ethylhexane, 2,2,3-trimethylpentane, 2,2,4-trimethylpentane, 2,3,3-trimethylpentane, 2,3,4-trimethylpentane, 2-methyl-3-ethylpentane, cyclooctane, methylcycloheptane, 1,1-dimethylcyclohexane, 1,2-dimethylcyclohexane, 1,3-dimethylcyclohexane, 1,4-dimethylcyclohexane, ethylcyclohexane, 1,1,2-trimethylcyclopentane, 1,1,3-trimethylcyclopentane, 1,2,3-

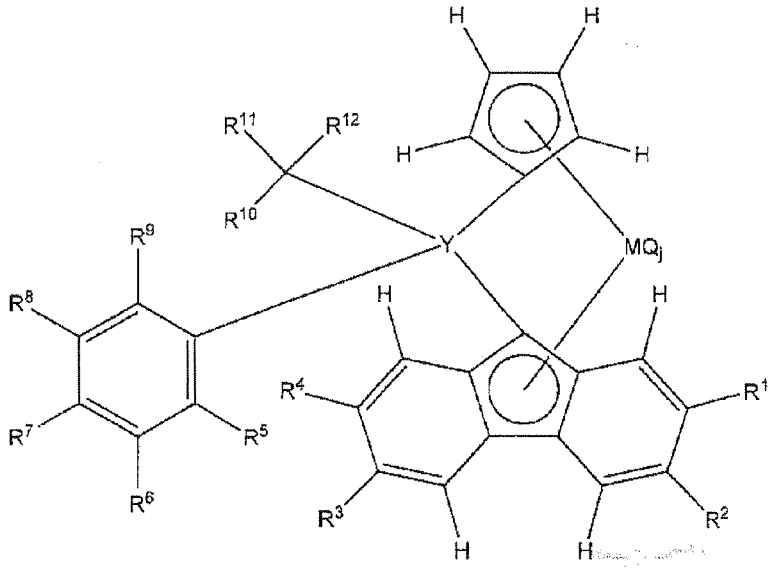
trimethylcyclopentane, 1,2,4-trimethylcyclopentane, 1-ethyl-1-methylcyclopentane, 1-ethyl-2-methylcyclopentane, 1-ethyl-3-methylcyclopentane, propylcyclopentane, isopropylcyclopentane, 1,2,3,4-tetramethylcyclobutane, 1,1,3,3-tetiramethylcyclobutane, 2,2,3,3-tetiramethylcyclobutane, 1,2-diethylcyclobutane, 1-butyl-2-methylcyclopropane, pentylcyclopropane, isopentylcyclopropane, nonane, 2-methyloctane, 3-methyloctane, 4-methyloctane, 2,2-dimethylheptane, 2,3-dimethylheptane, 2,4-dimethylheptane, 2,5-dimethylheptane, 2,6-dimethylheptane, 4,4-dimethylheptane, 2-ethylheptane, 3-ethylheptane, 4-ethylheptane, 2,2,3-trimethylhexane, 2,2,4-trimethylhexane, 2,2,5-trimethylhexane, 2,3,3-trimethylhexane, 2,3,4-trimethylhexane, 2,3,5-trimethylhexane, 2,4,4-trimethylhexane, 3,3,4-trimethylhexane, 3-ethyl-2-methylhexane, 3-ethyl-3-methylhexane, 4-ethyl-2-methylhexane, 4-ethyl-3-methylhexane, 2,2,3,3-tetramethylpentane, 2,2,3,4-tetramethylpentane, 2,2,4,4-tetramethylpentane, 2,3,3,4-tetramethylpentane, 2,2-dimethyl-3-ethylpentane, 2,2-diethylpentane, 2,3-diethylpentane, cyclononane, methylcyclooctane, ethylcycloheptane, 1,1-dimethylcycloheptane, 1,2-dimethylcycloheptane, 1,3-dimethylcycloheptane, 1,4-dimethylcycloheptane, propylcyclohexane, isopropylcyclohexane, 1-ethyl-2-methylcyclohexane, 1-ethyl-3-methylcyclohexane, 1-ethyl-4-

methylcyclohexane, 1,1,2-trimethylcyclohexane, 1,1,3-trimethylcyclohexane, 1,1,4-trimethylcyclohexane, 1,2,3-trimethylcyclohexane, 1,2,4-trimethylcyclohexane, butylcyclopentane, isobutylcyclopentane, 2-cyclopentylbutane, 1,2-diethylcyclopentane, 1-isopropyl-3-methylcyclopentane, 1-methyl-2-propylcyclopentane, 2-ethyl-1,1-dimethylcyclopentane, 1,1,3,3-tetramethylcyclopentane, 1,1,3,4-tetramethylcyclopentane, 1,2,3,4-tetramethylcyclopentane, 1,1,2,3,3-pentamethylcyclobutane, 1,2-dipropylcyclopropane, 1-hexylcyclopropane, 1-pentyl-1-methylcyclopropane, 1-pentyl-2-methylcyclopropane, decane, 2-methylnonane, 3-methylnonane, 4-methylnonane, 5-methylnonane, 2,2-dimethyloctane, 2,3-dimethyloctane, 2,4-dimethyloctane, 2,5-dimethyloctane, 2,6-dimethyloctane, 2,7-dimethyloctane, 3,3-dimethyloctane, 3,4-dimethyloctane, 3,5-dimethyloctane, 3,6-dimethyloctane, 4,4-dimethyloctane, 4,5-dimethyloctane, 3-ethyloctane, 4-ethyloctane, 2,2,3-trimethylheptane, 2,2,4-trimethylheptane, 2,2,5-trimethylheptane, 2,2,5-trimethylheptane, 2,2,6-trimethylheptane, 2,3,3-trimethylheptane, 2,3,4-trimethylheptane, 2,3,5-trimethylheptane, 2,3,6-trimethylheptane, 2,4,4-trimethylheptane, 2,4,5-trimethylheptane, 2,4,6-trimethylheptane, 2,5,5-trimethylheptane, 2-methyl-3-ethylheptane, 2-methyl-4-ethylheptane, 3-ethyl-3-methylheptane, 3-ethyl-4-

methylheptane, 3-ethyl-5-methylheptane, 3-methyl-4-ethylheptane, 5-ethyl-2-methylheptane, 3,3,4-trimethylheptane, 3,3,5-trimethylheptane, 3,4,4-trimethylheptane, 3,4,5-trimethylheptane, 4-propylheptane, 4-isopropylheptane, 2,2,3,3-tetramethylhexane, 2,2,3,4-tetramethylhexane, 2,2,3,5-tetramethylhexane, 2,2,4,4-tetramethylhexane, 2,2,4,5-tetramethylhexane, 2,2,5,5-tetramethylhexane, 2,3,3,4-tetramethylhexane, 2,3,3,5-tetramethylhexane, 2,3,4,4-tetramethylhexane, 2,3,4,5-tetramethylhexane, 3,3,4,4-tetramethylhexane, 2,2-dimethyl-3-ethylhexane, 2,3-dimethyl-3-ethylhexane, 2,3-dimethyl-4-ethylhexane, 2,4-dimethyl-4-ethylhexane, 2,5-dimethyl-3-ethylhexane, 3,3-dimethyl-4-ethylhexane, 3,4-dimethyl-3-ethylhexane, 3-ethyl-2,4-dimethylhexane, 4-ethyl-2,2-dimethylhexane, 3,3-diethylhexane, 3,4-diethylhexane, 2,2,3,3,4-pentamethylpentane, 2,2,3,4,4-pentamethylpentane, 2,2,3-trimethyl-3-ethylpentane, 2,2,4-trimethyl-3-ethylpentane, 2,3,4-trimethyl-3-ethylpentane, 2,4-dimethyl-3-isopropylpentane, 2-methyl-3-3-diethylpentane, 4-ethyl-4-methylpentane, cyclodecane, methylcyclononane, 1,5-dimethylcyclooctane, ethylcyclooctane, cycloheptane, 1,1,2,3-tetramethylcyclohexane, 1,1,3,3-tetramethylcyclohexane, 1,1,3,5-tetramethylcyclohexane, 1,1,4,4-tetramethylcyclohexane, 1,2,2,4-tetramethylcyclohexane,

1,2,3,4-tetramethylcyclohexane, 1,2,3,5-tetramethylcyclohexane, 1,2,4,5-tetramethylcyclohexane, butylcyclohexane, 1,3-diethylcyclohexane, 1,4-diethylcyclohexane, 1-ethyl-2-propylcyclohexane, 1,3-dimethyl-5-ethylcyclohexane, 1-ethyl-2,3-dimethylcyclohexane, 1-ethyl-2,4-dimethylcyclohexane, 1-isopropyl-1-methylcyclohexane, 1-isopropyl-2-methylcyclohexane, 1-isopropyl-3-methylcyclohexane, 1-isopropyl-4-methylcyclohexane, 1-methyl-2-propylcyclohexane, 1-methyl-3-propylcyclohexane, 2-ethyl-1,3-dimethylcyclohexane, sec-butylcyclohexane, tert-butylcyclohexane, isobutylcyclohexane, 1,2,3,4,5-pentamethylcyclopentane, 1,2,3-trimethyl-4-ethylcyclopentane, 1,2-dimethyl-3-isopropylcyclopentane, 1-ethyl-3-isopropylcyclopentane, 1-methyl-2,4-diethylcyclopentane, 1-methyl-2-butylcyclopentane, 1-methyl-3-tert-butylcyclopentane, 1-methyl-3-isobutylcyclopentane, 2-isopropyl-1,3-dimethylcyclopentane, 2-cyclopentylpentane, 2-methylbutylcyclopentane, isopentylcyclopentane, pentylcyclopentane, 2-ethyl-1-methyl-3-propylcyclobutane, 1,1,2-trimethyl-3-isobutylcyclopropane, 1,1-dimethyl-2-pentylcyclopropane, 1,2-dimethyl-1-pentylcyclopropane, 1,2-dimethyl-3-pentylcyclopropane, 1-ethyl-2-pentylcyclopropane, 1-hexyl-2-methylcyclopropane, 1-methyl-2-(1-methylpentyl)cyclopropane, and 1-methyl-2-(3-

methylpentyl)cyclopropane;



. . . . [1]

where

R^1 to R^4 each independently represent a group selected

from hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups, and two adjoining groups are optionally bonded to each other to form a ring;

R^5 to R^9 each independently represent a group selected from a hydrogen atom, halogen atoms, hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups, and two adjoining groups are optionally bonded to each other to form a ring;

R^{10} to R^{12} each independently represent a group selected from a hydrogen atom, halogen atoms, hydrocarbon groups, halogen-containing hydrocarbon groups, nitrogen-containing groups, oxygen-containing groups, and silicon-containing groups;

Y represents a carbon atom or a silicon atom;

M represents Ti, Zr, or Hf;

Q is a structure selected from halogen atoms, hydrocarbon groups, neutral, conjugated or nonconjugated dienes having 10 or less carbon atoms, anion ligands, and neutral ligands capable of coordinating with a lone pair; j represents an integer from 1 to 4; and in the case where j represents an integer of 2 or more, multiple Qs are the same as or different from each other~~]~~.

[Claim 2]

The method for producing an olefin polymer according to Claim 1, wherein in Formula [1], R^1 and R^4 are each independently a group selected from hydrocarbon groups having 1 to 40 carbon atoms and halogen-containing hydrocarbon groups having 1 to 40 carbon atoms, and at least one of R^2 and R^3 is a group selected from hydrocarbon groups having 1 to 40 carbon atoms and silicon-containing groups.

[Claim 3]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1~~ and 2~~, wherein in Formula [1], R^1 and R^4 are each independently a group selected from aryl groups having 6 to 20 carbon atoms and halogen-containing aryl groups having 6 to 20 carbon atoms.

[Claim 4]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1~~ and 2~~, wherein in Formula [1], R^{12} is a group selected from a hydrogen atom, hydrocarbon groups having 1 to 40 carbon atoms, and halogen-containing hydrocarbon groups having 1 to 40 carbon atoms.

[Claim 5]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1~~ and 2~~, wherein in Formula [1], each of R^{10} and R^{11} is a hydrogen atom, and R^{12} is a group selected from

alkyl groups having 1 to 20 carbon atoms, aryl groups having 6 to 20 carbon atoms and halogen-containing aryl groups having 6 to 20 carbon atoms, or each of R^{10} to R^{12} is a hydrogen atom.

[Claim 6]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1 ~~and 2~~, wherein in Formula [1], R^5 to R^9 are each independently a group selected from a hydrogen atom, halogen atoms, and alkyl groups having 1 to 20 carbon atoms.

[Claim 7]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1 ~~and 2~~, wherein the catalyst for olefin polymerization further comprises a support (C).

[Claim 8]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1 ~~and 2~~, wherein at least propylene is used as the olefin.

[Claim 9]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1 ~~and 2~~, wherein the solubility of the bridged metallocene compound represented by Formula [1] in n-hexane at 25°C is not less than 0.5 mmol/L.

[Claim 10]

The method for producing an olefin polymer according to

~~any one of C~~claim~~s~~ 1~~ and 2~~, wherein a solution in which the concentration of the bridged metallocene compound represented by Formula [1] is in the range of 0.05 mmol/L to 1.0 mol/L is supplied to a polymerization system.

[Claim 11]

The method for producing an olefin polymer according to ~~any one of C~~claim~~s~~ 1~~ and 2~~, wherein polymerization temperature is in the range of 50 to 150°C.

[Claim 12]

The method for producing a propylene polymer according to ~~any one of C~~claims 1~~ and 2~~, wherein polymerization temperature is in the range of 50 to 150°C., and a propylene polymer that is to be produced has the following properties; melting point (Tm) measured by differential scanning calorimetry (in the case where multiple crystalline melting peaks are observed, the melting point (Tm) is based on the high-temperature side peak) is in the range of 145 to 170°C., intrinsic viscosity ([η]) measured in decalin at 135°C. is not less than 1.25 dl/g, weight average molecular weight (Mw) measured by gel permeation chromatography is not less than 97,000, and a proportion of weight average molecular weight (Mw) to number average molecular weight (Mn) (Mw/Mn) is in the range of 1 to 3.

[Claim 13]

The method for producing an olefin polymer according to Claim 1,

wherein a solution in which the bridged metallocene compound (A) is dissolved in a hydrocarbon solvent is supplied to a polymerization system,

wherein the hydrocarbon solvent is at least one selected from butane, isobutane, cyclobutane, methylcyclopropane, pentane, isopentane, neopentane, cyclopentane, methylcyclobutane, 1,1-dimethylcyclopropane, 1,2-dimethylcyclopropane, ethylcyclopropane, hexane, 3-methylpentane, 2-methylpentane, 2,2-dimethylbutane, 2,3-dimethylbutane, cyclohexane, methylcyclopentane, 1,1-dimethylcyclobutane, 1,2-dimethylcyclobutane, 1,3-dimethylcyclobutane, ethylcyclobutane, 1,1,2-trimethylcyclopropane, 1-ethyl-1-methylcyclopropane, propylcyclopropane, isopropylcyclopropane, heptane, 2-methylhexane, 3-methylhexane, 3-ethylpentane, 2,2-dimethylpentane, 2,3-dimethylpentane, 2,4-dimethylpentane, 3,3-dimethylpentane, 2,2,3-trimethylbutane, methylcyclohexane, 1,2-dimethylpentane, 1,3-dimethylpentane, 1,2,3-trimethylbutane, cycloheptane, methylcyclohexane, 1,1-dimethylcyclopentane, 1,2-dimethylcyclopentane, 1,3-dimethylcyclopentane, ethylcyclopentane, propylcyclobutane, 1,1,2,2-tetramethylcyclopropane, 1,1,2,3-tetramethylcyclopropane, 1,1-diethylcyclopropane, 1-isopropyl-1-methylcyclopropane, 1-isopropyl-2-methylcyclopropane, 1-propyl-2-methylcyclopropane, butylcyclopropane, octane, 2-methylheptane, 3-methylheptane, 4-methylheptane, 2,2-dimethylhexane, 2,3-dimethylhexane, 2,4-dimethylhexane, 2,5-dimethylhexane, 3,3-dimethylhexane, 3,4-dimethylhexane, 3-ethylhexane, 2,2,3-trimethylpentane, 2,2,4-trimethylpentane, 2,3,3-trimethylpentane, 2,3,4-trimethylpentane, 2-methyl-3-ethylpentane, cyclooctane, methylcycloheptane, 1,1-dimethylcyclohexane, 1,2-

dimethylcyclohexane, 1,3-dimethylcyclohexane, 1,4-dimethylcyclohexane, ethylcyclohexane, 1,1,2-trimethylcyclopentane, 1,1,3-trimethylcyclopentane, 1,2,3-trimethylcyclopentane, 1,2,4-trimethylcyclopentane, 1-ethyl-1-methylcyclopentane, 1-ethyl-2-methylcyclopentane, 1-ethyl-3-methylcyclopentane, propylcyclopentane, isopropylcyclopentane, 1,2,3,4-tetramethylcyclobutane, 1,1,3,3-tetiramethylcyclobutane, 2,2,3,3-tetiramethylcyclobutane, 1,2-diethylcyclobutane, 1-butyl-2-methylcyclopropane, pentylcyclopropane, isopentylcyclopropane, nonane, 2-methyloctane, 3-methyloctane, 4-methyloctane, 2,2-dimethylheptane, 2,3-dimethylheptane, 2,4-dimethylheptane, 2,5-dimethylheptane, 2,6-dimethylheptane, 4,4-dimethylheptane, 2-ethylheptane, 3-ethylheptane, 4-ethylheptane, 2,2,3-trimethylhexane, 2,2,4-trimethylhexane, 2,2,5-trimethylhexane, 2,3,3-trimethylhexane, 2,3,4-trimethylhexane, 2,3,5-trimethylhexane, 2,4,4-trimethylhexane, 3,3,4-trimethylhexane, 3-ethyl-2-methylhexane, 3-ethyl-3-methylhexane, 4-ethyl-2-methylhexane, 4-ethyl-3-methylhexane, 2,2,3,3-tetramethylpentane, 2,2,3,4-tetramethylpentane, 2,2,4,4-tetramethylpentane, 2,3,3,4-tetramethylpentane, 2,2-dimethyl-3-ethylpentane, 2,2-diethylpentane, 2,3-diethylpentane, cyclononane, methylcyclooctane, ethylcycloheptane, 1,1-dimethylcycloheptane, 1,2-dimethylcycloheptane, 1,3-dimethylcycloheptane, 1,4-dimethylcycloheptane, propylcyclohexane, isopropylcyclohexane, 1-ethyl-2-methylcyclohexane, 1-ethyl-3-methylcyclohexane, 1-ethyl-4-methylcyclohexane, 1,1,2-trimethylcyclohexane, 1,1,3-trimethylcyclohexane, 1,1,4-trimethylcyclohexane, 1,2,3-trimethylcyclohexane, 1,2,4-trimethylcyclohexane, butylcyclopentane, isobutylcyclopentane, 2-cyclopentylbutane, 1,2-diethylcyclopentane, 1-isopropyl-3-methylcyclopentane, 1-methyl-2-propylcyclopentane, 2-ethyl-1,1-dimethylcyclopentane, 1,1,3,3-tetramethylcyclopentane, 1,1,3,4-

tetramethylcyclopentane, 1,2,3,4-tetramethylcyclopentane, 1,1,2,3,3-pentamethylcyclobutane, 1,2-dipropylcyclopropane, 1-hexylcyclopropane, 1-pentyl-1-methylcyclopropane, 1-pentyl-2-methylcyclopropane, decane, 2-methylnonane, 3-methylnonane, 4-methylnonane, 5-methylnonane, 2,2-dimethyloctane, 2,3-dimethyloctane, 2,4-dimethyloctane, 2,5-dimethyloctane, 2,6-dimethyloctane, 2,7-dimethyloctane, 3,3-dimethyloctane, 3,4-dimethyloctane, 3,5-dimethyloctane, 3,6-dimethyloctane, 4,4-dimethyloctane, 4,5-dimethyloctane, 3-ethyloctane, 4-ethyloctane, 2,2,3-trimethylheptane, 2,2,4-trimethylheptane, 2,2,5-trimethylheptane, 2,2,5-trimethylheptane, 2,2,6-trimethylheptane, 2,3,3-trimethylheptane, 2,3,4-trimethylheptane, 2,3,5-trimethylheptane, 2,3,6-trimethylheptane, 2,4,4-trimethylheptane, 2,4,5-trimethylheptane, 2,4,6-trimethylheptane, 2,5,5-trimethylheptane, 2-methyl-3-ethylheptane, 2-methyl-4-ethylheptane, 3-ethyl-3-methylheptane, 3-ethyl-4-methylheptane, 3-ethyl-5-methylheptane, 3-methyl-4-ethylheptane, 5-ethyl-2-methylheptane, 3,3,4-trimethylheptane, 3,3,5-trimethylheptane, 3,4,4-trimethylheptane, 3,4,5-trimethylheptane, 4-propylheptane, 4-isopropylheptane, 2,2,3,3-tetramethylhexane, 2,2,3,4-tetramethylhexane, 2,2,3,5-tetramethylhexane, 2,2,4,4-tetramethylhexane, 2,2,4,5-tetramethylhexane, 2,2,5,5-tetramethylhexane, 2,3,3,4-tetramethylhexane, 2,3,3,5-tetramethylhexane, 2,3,4,4-tetramethylhexane, 2,3,4,5-tetramethylhexane, 3,3,4,4-tetramethylhexane, 2,2-dimethyl-3-ethylhexane, 2,3-dimethyl-3-ethylhexane, 2,3-dimethyl-4-ethylhexane, 2,4-dimethyl-4-ethylhexane, 2,5-dimethyl-3-ethylhexane, 3,3-dimethyl-4-ethylhexane, 3,4-dimethyl-3-ethylhexane, 3-ethyl-2,4-dimethylhexane, 4-ethyl-2,2-dimethylhexane, 3,3-diethylhexane, 3,4-diethylhexane, 2,2,3,3,4-pentamethylpentane, 2,2,3,4,4-pentamethylpentane, 2,2,3-trimethyl-3-ethylpentane, 2,2,4-trimethyl-3-ethylpentane, 2,3,4-

trimethyl-3-ethylpentane, 2,4-dimethyl-3-isopropylpentane, 2-methyl-3-3-diethylpentane, 4-ethyl-4-methylpentane, cyclodecane, methylcyclononane, 1,5-dimethylcyclooctane, ethylcyclooctane, cycloheptane, 1,1,2,3-tetramethylcyclohexane, 1,1,3,3-tetramethylcyclohexane, 1,1,3,5-tetramethylcyclohexane, 1,1,4,4-tetramethylcyclohexane, 1,2,2,4-tetramethylcyclohexane, 1,2,3,4-tetramethylcyclohexane, 1,2,3,5-tetramethylcyclohexane, 1,2,4,5-tetramethylcyclohexane, butylcyclohexane, 1,3-diethylcyclohexane, 1,4-diethylcyclohexane, 1-ethyl-2-propylcyclohexane, 1,3-dimethyl-5-ethylcyclohexane, 1-ethyl-2,3-dimethylcyclohexane, 1-ethyl-2,4-dimethylcyclohexane, 1-isopropyl-1-methylcyclohexane, 1-isopropyl-2-methylcyclohexane, 1-isopropyl-3-methylcyclohexane, 1-isopropyl-4-methylcyclohexane, 1-methyl-2-propylcyclohexane, 1-methyl-3-propylcyclohexane, 2-ethyl-1,3-dimethylcyclohexane, sec-butylcyclohexane, tert-butylcyclohexane, isobutylcyclohexane, 1,2,3,4,5-pentamethylcyclopentane, 1,2,3-trimethyl-4-ethylcyclopentane, 1,2-dimethyl-3-isopropylcyclopentane, 1-ethyl-3-isopropylcyclopentane, 1-methyl-2,4-diethylcyclopentane, 1-methyl-2-butylcyclopentane, 1-methyl-3-tert-butylcyclopentane, 1-methyl-3-isobutylcyclopentane, 2-isopropyl-1,3-dimethylcyclopentane, 2-cyclopentylpentane, 2-methylbutylcyclopentane, isopentylcyclopentane, pentylcyclopentane, 2-ethyl-1-methyl-3-propylcyclobutane, 1,1,2-trimethyl-3-isobutylcyclopropane, 1,1-dimethyl-2-pentylcyclopropane, 1,2-dimethyl-1-pentylcyclopropane, 1,2-dimethyl-3-pentylcyclopropane, 1-ethyl-2-pentylcyclopropane, 1-hexyl-2-methylcyclopropane, 1-methyl-2-(1-methylpentyl)cyclopropane, and 1-methyl-2-(3-methylpentyl)cyclopropane.

[Claim 13]

The method for producing an olefin polymer according to claim 2, wherein in Formula [1], R^1 and R^4 are each independently a group selected from aryl groups having 6 to 20 carbon atoms and halogen-containing aryl groups having 6 to 20 carbon atoms.

[Claim 14]

The method for producing an olefin polymer according to claim 2, wherein in Formula [1], R^{12} is a group selected from a hydrogen atom, hydrocarbon groups having 1 to 40 carbon atoms, and halogen-containing hydrocarbon groups having 1 to 40 carbon atoms.

[Claim 15]

The method for producing an olefin polymer according to claim 2, wherein in Formula [1], each of R^{10} and R^{11} is a hydrogen atom, and R^{12} is a group selected from alkyl groups having 1 to 20 carbon atoms, aryl groups having 6 to 20 carbon atoms and halogen-containing aryl groups having 6 to 20 carbon atoms, or each of R^{10} to R^{12} is a hydrogen atom.

[Claim 16]

The method for producing an olefin polymer according to claim 2, wherein in Formula [1], R^5 to R^9 are each independently a group selected from a hydrogen atom, halogen atoms, and alkyl groups having 1 to 20 carbon atoms.

[Claim 17]

The method for producing an olefin polymer according to claim 2, wherein the catalyst for olefin polymerization further comprises a support (C).

[Claim 18]

The method for producing an olefin polymer according to claim 2, wherein at least propylene is used as the olefin.

[Claim 19]

The method for producing an olefin polymer according to claim 2, wherein the solubility of the bridged metallocene compound represented by Formula [1] in n-hexane at 25°C. is not less than 0.5 mmol/L.

[Claim 20]

The method for producing an olefin polymer according to claim 2, wherein a solution in which the concentration of the bridged metallocene compound represented by Formula [1] is in the range of 0.05 mmol/L to 1.0 mol/L is supplied to a polymerization system.