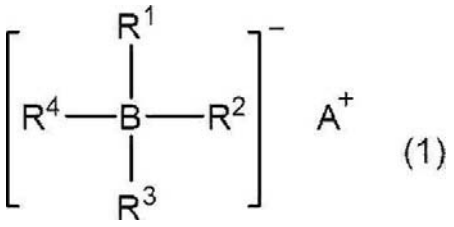
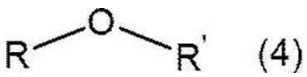
[CLAIMS]

[Claim 1]

A composition containing a compound represented by the following formula (1) and a compound represented by the following formula (4):



(1)

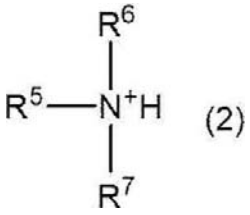


(4)

wherein

R^1, R^2, R^3 and R^4 are each independently a C_{6-14} aryl group substituted by one or more fluorine atoms or one or more fluoro C_{1-4} alkyl groups,

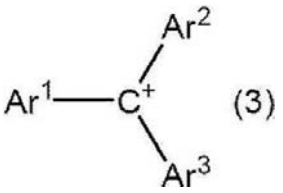
A^+ is a hydrogen ion (H^+), a cation having a total carbon number of not less than 25 and represented by the formula (2):



(2)

wherein R^5, R^6 and R^7 are each independently a C_{1-30} alkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, or a C_{6-14} aryl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, or a cation having a total carbon

number of not less than 25 and represented by the formula (3):



(3)

wherein Ar^1, Ar^2 and Ar^3 are each independently a C_{6-14} aryl group optionally substituted by one or more C_{1-30} alkyl groups or C_{1-30} alkoxy groups, and

R and R' are each independently a C_{1-30} alkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, a C_{3-15} cycloalkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, or a C_{6-14} aryl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group,

provided that when A^+ is a hydrogen ion (H^+), a total carbon number of R and R' is not less than 20, and a content of the compound represented by the formula (4) with respect to 1 mol of the compound represented by the formula (1) is not less than 2 mol, and

when A^+ is a cation represented by the formula (2) or a cation represented by the formula (3), a total carbon number of R and R' is not less than 8.

[Claim 2]

The composition according to claim 1, wherein

R and R' are each independently a C_{1-30} alkyl group or a C_{6-14} aryl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, and

the total carbon number of R and R' is

not less than 25 when A^+ is a hydrogen ion (H^+),

not less than 8 when A^+ is a cation represented by the formula (2) or a cation represented by the formula (3).

[Claim 3]

The composition according to claim 1 or 2, wherein R^1, R^2, R^3 and R^4 are each independently a phenyl group, a 1-naphthyl group, a 2-naphthyl group, a 2-biphenylyl group, a 3-biphenylyl group, a 4-biphenylyl group, a 1-anthryl group, a 2-anthryl group, a 9-anthryl group, a 9-phenanthryl group, or a 3-phenanthryl group, each of which is substituted by one or more fluorine atoms or trifluoromethyl groups.

[Claim 4]

The composition according to claim 1 or 2, wherein all of R^1, R^2, R^3 and R^4 are pentafluorophenyl groups, 2,2',3,3',4',5,5',6,6'-nonafluoro-4-(1,1'-biphenylyl) groups, 2,3,4,5,6,7,8-heptafluoro-1-naphthyl groups, or 1,3,4,5,6,7,8-heptafluoro-2-naphthyl groups.

[Claim 5]

The composition according to any one of claims 1 to 4, wherein A^+ is a hydrogen ion.

[Claim 6]

The composition according to any one of claims 1 to 4, wherein A^+ is a cation having a total carbon number of not less than 35 and represented by the formula (2), and

R^5, R^6 and R^7 are each independently a C_{1-30} alkyl group, or a C_{6-14} aryl group optionally substituted by substituent(s) selected from the group consisting of

(1) a halogen atom,
(2) a C_{1-30} alkyl group,
(3) a C_{1-30} alkoxy group, and
(4) a halo C_{1-30} alkyl group.

[Claim 7]

The composition according to any one of claims 1 to 4, wherein A^+ is a cation having a total carbon number of not less than 35 and represented by the formula (2),
R^5 is a C_{6-14} aryl group optionally substituted by substituent(s) selected from the group consisting of
(1) a halogen atom,
(2) a C_{1-30} alkyl group,
(3) a C_{1-30} alkoxy group, and
(4) a halo C_{1-6} alkyl group, and
R^6 and R^7 are each independently a C_{1-30} alkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group.

[Claim 8]

The composition according to any one of claims 1 to 4, wherein A^+ is a cation having a total carbon number of not less than 35 and represented by the formula (2),
R^5 is a C_{1-30} alkyl group substituted by a C_{6-14} aryl group substituted by one or more fluorine atoms, or a C_{1-30} alkyl group substituted by one or more fluorine atoms, and
R^6 and R^7 are each independently a C_{1-30} alkyl group optionally substituted by substituent(s) selected from the group consisting of
(1) a C_{6-14} aryl group optionally substituted by halogen atom(s),
(2) a halogen atom, and
(3) a C_{1-30} alkoxy group.

[Claim 9]

The composition according to any one of claims 1 to 4,

wherein A^+ is a cation having a total carbon number of not less than 35 and represented by the formula (2),

R^5 is a fluoro C_{1-6} alkyl group, and

R^6 and R^7 are each independently a C_{1-30} alkyl group optionally substituted by substituent(s) selected from the group consisting of

(1) a C_{6-14} aryl group optionally substituted by halogen atom(s),

(2) a halogen atom, and

(3) a C_{1-30} alkoxy group.

[Claim 10]

The composition according to any one of claims 1 to 4, wherein A^+ is a cation having a total carbon number of not less than 35 and represented by the formula (3), and

Ar^1, Ar^2 and Ar^3 are each independently a phenyl group optionally substituted by a C_{1-30} alkyl group or a C_{1-30} alkoxy group.

[Claim 11]

The composition according to any one of claims 1 to 4, wherein A^+ is a hydrogen ion, and

R and R' are each independently a C_{1-30} alkyl group optionally substituted by substituent(s) selected from the group consisting of

(1) a halogen atom,

(2) a C_{1-30} alkoxy group, and

(3) a halo C_{1-30} alkoxy group;

a C_{3-15} cycloalkyl group optionally substituted by substituent(s) selected from the group consisting of

(1) a halogen atom,

(2) a C_{1-30} alkyl group,

(3) a C_{1-30} alkoxy group,

(4) a halo C_{1-30} alkyl group, and

(5) a halo C_{1-30} alkoxy group; or

a C_{6-14} aryl group optionally substituted by substituent(s) selected from the group consisting of

(1) a halogen atom,

(2) a C_{1-30} alkyl group,

(3) a C_{1-30} alkoxy group,

(4) a halo C_{1-30} alkyl group, and

(5) a halo C_{1-30} alkoxy group.

[Claim 12]

The composition according to any one of claims 1 to 4, wherein A^+ is a hydrogen ion, and R and R' are each independently a C_{1-30} alkyl group.

[Claim 13]

The composition according to any one of claims 1 to 4, wherein A^+ is a hydrogen ion,
R and R' are each independently a C_{14-30} alkyl group, and
the total carbon number of R and R' is not less than 28.

[Claim 14]

The composition according to any one of claims 1 to 4, wherein A^+ is a hydrogen ion, and
R and R' are the same group.

[Claim 15]

The composition according to any one of claims 1 to 4 and 6 to 10, wherein A^+ is a cation represented by the formula (2) or the formula (3), R and R' are each independently a C_{1-30} alkyl group, and the total carbon number of R and R' is not less than 8.

[Claim 16]

The composition according to any one of claims 1 to 4, 6 to 10, and 15, wherein a content of the compound represented by the formula (4) with respect to 1 mol of the compound represented by the formula (1) (wherein A^+ is a cation represented by the formula (2) or the formula (3)) is within the range of 0.01 - 10 mol.

[Claim 17]

The composition according to any one of claims 1 to 4, 6 to 10, and 15, wherein a content of the compound represented by the formula (4) with respect to 1 mol of the compound represented by the formula (1) (wherein A^+ is a cation

represented by the formula (2) or the formula (3)) is within the range of 0.01 - 3 mol.

[Claim 18]

The composition according to any one of claims 1 to 17, having a solubility of not less than 5 wt% in n-hexane, isohexane, n-heptane, n-octane, cyclohexane, methylcyclohexane, or a mixed solvent thereof at 25°C.

[Claim 19]

The composition according to any one of claims 1 to 18, substantially free of an ether having a total carbon number of not more than 7.

[Claim 20]

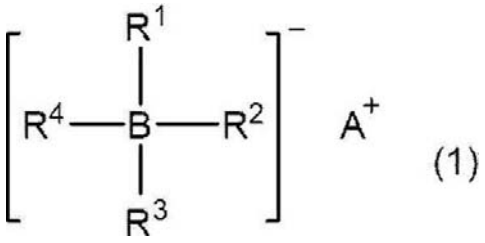
A cocatalyst for polymerization of at least one kind of monomer selected from the group consisting of an olefin and a diene, consisting of the composition according to any one of claims 1 to 19.

[Claim 21]

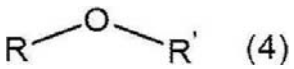
A method for producing a polymer, comprising polymerizing at least one kind of monomer selected from the group consisting of an olefin and a diene by using the composition according to any one of claims 1 to 19 as a cocatalyst.

[Claim 22]

A composition comprising a compound represented by the following formula (1) and a compound represented by the following formula (4):



(1)



(4)

wherein

R^1, R^2, R^3 and R^4 are each independently a C_{6-14} aryl group substituted by one or more fluorine atoms or one or more fluoro

C_{1-4} alkyl groups,

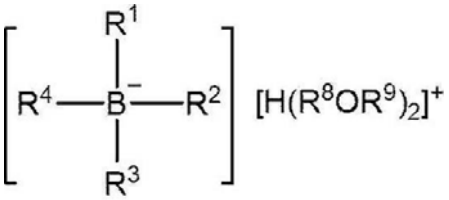
A^+ is a hydrogen ion (H^+),

R and R' are each independently a C_{1-30} alkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, a C_{3-15} cycloalkyl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group, or a C_{6-14} aryl group optionally substituted by one or more substituent(s) selected from the group consisting of (1) a halogen atom, (2) a nitro group, (3) a cyano group, (4) a C_{1-30} alkyl group, (5) a halo C_{1-30} alkyl group, (6) a C_{3-8} cycloalkyl group, (7) a C_{1-30} alkoxy group, (8) a halo C_{1-30} alkoxy group, and (9) a C_{6-14} aryl group,

a total carbon number of R and R' is not less than 20, and

a content of the compound represented by the formula (4) with respect to 1 mol of the compound represented by the formula (1) is not less than 2 mol,

comprising a step of reacting a compound represented by the following formula (5):



(5)

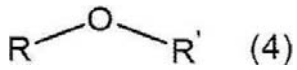
wherein

R^1, R^2, R^3 and R^4 are as defined above,

R^8 and R^9 are each independently a C_{1-6} alkyl group, and

a total carbon number of R^8OR^9 is not more than 7,

with a compound represented by the following formula (4):



(4)

wherein R and R' are as defined above.

[Claim 23]

The production method according to claim 22, wherein both R^8 and R^9 are ethyl groups.