CLAIMS

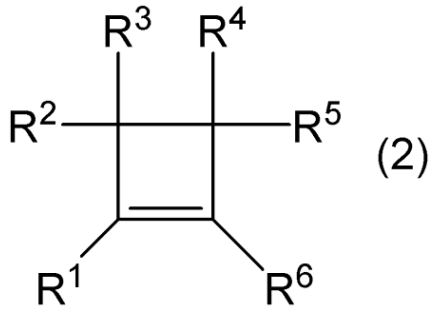
[Claim 1]

A method for producing a halogenated cycloalkane compound, comprising:

(I) bringing a catalyst into contact with a hydrogen-containing gas to obtain a hydrogenated catalyst, and

(IIa) reacting a halogenated cycloalkene compound and a hydrogen-containing gas in the presence of a hydrogenated catalyst to obtain a halogenated cycloalkane compound,

wherein the halogenated cycloalkene compound is a halogenated cycloalkene compound represented by formula (2):



(2)

wherein R^1, R^2, R^3, R^4, R^5, and R6 are the same or different and each is a hydrogen atom, a halogen atom, or a perfluoroalkyl group; when cis-trans isomers are present, both isomers are contained; provided that not all of R^1, R^2, R^3, R^4, R^5, and R^6 are hydrogen atoms.

[Claim 2]

A method for producing a halogenated cycloalkane compound, comprising:

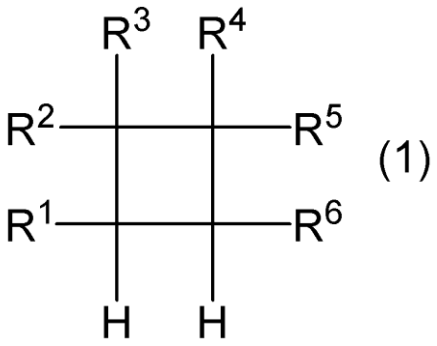
(IIb) reacting a halogenated cycloalkene compound and a hydrogen-containing gas in the presence of a catalyst having a hydrogen content of 0.1 to 1.5 mass% to obtain a halogenated cycloalkane compound.

[Claim 3]

The production method according to claim 1 or 2, wherein the hydrogenated catalyst or the catalyst having a hydrogen content of 0.1 to 1.5 mass% has a specific surface area of 50 to 500 m^2/g.

[Claim 4]

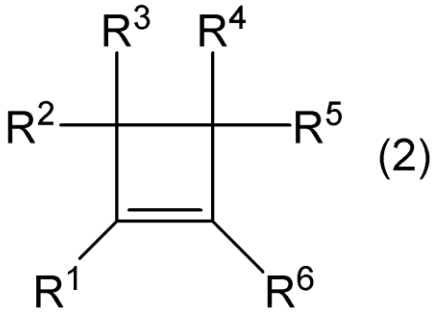
The production method according to any one of claims 1 to 3, wherein the halogenated cycloalkane compound is a halogenated cycloalkane compound represented by formula (1):



wherein R^1, R^2, R^3, R^4, R^5, and R^6 are the same or different and each is a hydrogen atom, a halogen atom, or a perfluoroalkyl group; when cis-trans isomers are present, both isomers are contained; provided that not all of R^1, R^2, R^3, R^4, R^5, and R^6 are hydrogen atoms.

[Claim 5]

The production method according to any one of claims 2 to 4, wherein the halogenated cycloalkene compound is a halogenated cycloalkene compound represented by formula (2):



wherein R^1, R^2, R^3, R^4, R^5, and R^6 are the same or different and each is a hydrogen atom, a halogen atom, or a perfluoroalkyl

group; when cis-trans isomers are present, both isomers are contained; provided that not all of R^1, R^2, R^3, R^4, R^5, and R^6 are hydrogen atoms.

[Claim 6]

The production method according to any one of claims 1 to 5, wherein the catalyst and hydrogenated catalyst comprise at least one transition metal element belonging to groups 8 to 11 of the periodic table.

[Claim 7]

The production method according to any one of claims 1 and 3 to 6, wherein step (I) is a step of bringing 10 mL to 1000 L of the hydrogen-containing gas into contact with 1 mol of the catalyst.

[Claim 8]

The production method according to any one of claims 1 and 3 to 7, wherein in step (I), the contact time (W/F) of the hydrogen-containing gas with the catalyst is 0.1 to 200 g·sec/cc.

[Claim 9]

A hydrogenated catalyst for use in obtaining a halogenated cycloalkane compound by reacting a halogenated cycloalkene compound and a hydrogen-containing gas, the hydrogenated catalyst having a hydrogen content of 0.1 to 1.5 mass%.

[Claim 10]

The hydrogenated catalyst according to claim 9, comprising at least one transition metal element belonging to groups 8 to 11 of the periodic table.

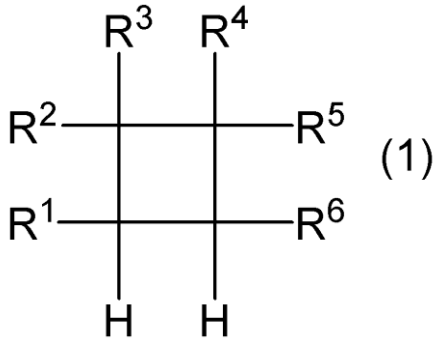
[Claim 11]

The hydrogenated catalyst according to claim 9 or 10,

which has a specific surface area of 50 to 500 m^2/g.

[Claim 12]

A composition comprising a halogenated cycloalkane compound represented by formula (1):



(1)

wherein R^1, R^2, R^3, R^4, R^5, and R^6 are the same or different and each is a hydrogen atom, a halogen atom, or a perfluoroalkyl group; when cis-trans isomers are present, both isomers are contained; provided that not all of R^1, R^2, R^3, R^4, R^5, and R^6 are hydrogen atoms,

the halogenated cycloalkane compound represented by formula (1) comprising cis-isomer of the halogenated cycloalkane compound and trans-isomer of halogenated cycloalkane compound,

the halogenated cycloalkane compound represented by formula (1) being contained in an amount of 90.0 to 99.9 mol% based on the total amount of the composition, which is taken as 100 mol%, and

the amount of the cis-isomer of the halogenated cycloalkane compound is 5.0 to 20.0 mol%, and the amount of the trans-isomer of the halogenated cycloalkane compound is 80.0 to 95.0 mol%, based on the total amount of the composition, which is taken as 100 mol%.

[Claim 13]

The composition according to claim 12, which is used as a cleaning gas or an etching gas.