DESCRIPTION

Title of Invention: METHOD FOR PRODUCING HALOGENATED CYCLOALKANE COMPOUND

Technical Field

[0001]

The present disclosure relates to a method for producing a halogenated cycloalkane compound.

Background Art

[0002]

Halogenated cycloalkane compounds are expected as dry etching gases for semiconductors, cleaning gases, and the like, and are saturated cyclic compounds having a halogen atom.

[0003]

As a method for producing a halogenated cycloalkane compound, for example, in NPL 1, hexafluorocyclobutane ($cC_4F_6H_2$) is obtained from hexafluorocyclobutene (cC_4F_6) in the presence of a palladium catalyst supported on alumina.

Citation List

Patent Literature

[0004]

NPL 1: Bulletin of the Academy of Sciences, 1962, pp. 2049-2051

Summary

Technical Problem

[0005]

An object of the present disclosure is to provide a method that can obtain a halogenated cycloalkane compound at a high conversion rate.

Solution to Problem

[0006]

The present disclosure includes the following

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%.

[0026]

Item 14. The composition according to Item 13, which is used as a cleaning gas or an etching gas.

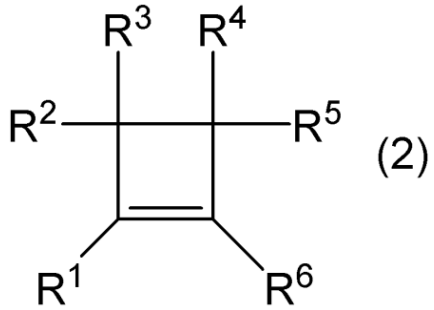
[0026a]

In one aspect, the present disclosure refers to 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.

[0026b]

In another aspect, the present disclosure refers to 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

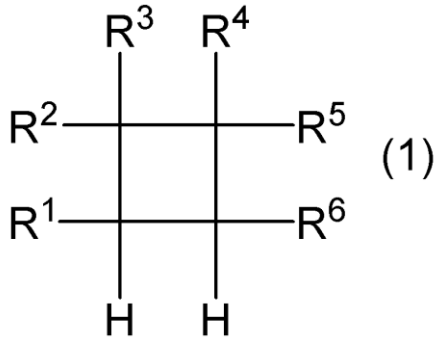
hydrogen content of 0.1 to 1.5 mass% to obtain a halogenated cycloalkane compound.

[0026c]

In yet another aspect, the present disclosure refers to 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%.

[0026d]

In yet another aspect, the present disclosure refers to 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%.

Advantageous Effects of Invention

[0027]

According to the present disclosure, a halogenated cycloalkane compound can be obtained at a high conversion rate.

Description of Embodiments

[0028]

In the present specification, the term “comprise” is a concept including “comprising,” “consisting essentially of,” and “consisting of.” In the present specification, the numerical range indicated by “A to B” means A or more and B or less.

[0029]

In the present disclosure, “selectivity” means the ratio (mol%) of the total molar amount of the target compound contained in the effluent gas from the reactor outlet, based on the total molar amount of compounds other than the raw material compound in the effluent gas.

[0030]

In the present disclosure, “conversion rate” means the ratio (mol%) of the total molar amount of compounds other than the raw material compound contained in the effluent gas from the reactor outlet, based on the molar amount of the raw material compound supplied to the reactor.

[0031]

In the present disclosure, “hydrogenated catalyst” refers to a catalyst that has been hydrogenated.

[0032]

1. Hydrogenated Catalyst