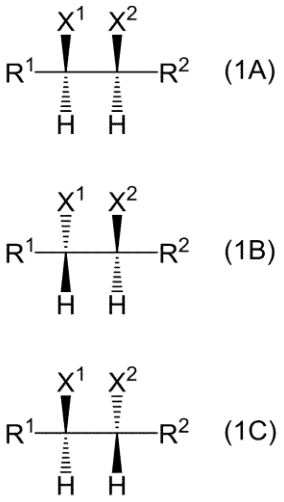
represented by formula (1C) are obtained based on the total amount of a product obtained by the hydrogenation step, which is taken as 100 mol%.

[0033]

Item 9. A composition comprising 3 alkane compounds represented by formulas (1A), (1B), and (1C):

[0034]



[0035]

wherein X^1 and X^2 are the same or different and each is a halogen atom, and R^1 and R^2 are the same or different and each is an alkyl group or a fluoroalkyl group; and

the alkane compound represented by formula (1A) being contained in an amount of 20 to 80 mol%, the alkane compound represented by formula (1B) being contained in an amount of 10 to 40 mol%, and the alkane compound represented by formula (1C) being contained in an amount of 10 to 40 mol%, based on the total amount of the composition, which is taken as 100 mol%.

[0036]

Item 10. The composition according to Item 9, which is used as an intermediate for organic synthesis, an etching gas, or a deposit gas.

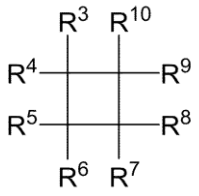
[0036a]

In one aspect, there is provided a method for producing an alkane compound represented by formula (1):

$R^1CHX^1CHX^2R^2$ (1)

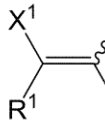
wherein X^1 and X^2 are the same or different and each is a fluorine atom, and R^1 and R^2 are the same or different and each is an alkyl group or a fluoroalkyl group; the method comprising:

(IIA) reacting, in the presence of a catalyst and a cycloalkane compound represented by formula (3):



(3)

wherein R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} are the same and each is a fluorine atom, or a fluoroalkyl group; an alkene compound represented by formula (2):



(2)

wherein X^1, X^2, R^1, and R^2 are as defined above; and a hydrogen-containing gas to hydrogenate the alkene compound represented by formula (2).

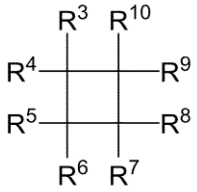
[0036b]

In another aspect, there is provided a method for producing an alkane compound represented by formula (1):

$R^1CHX^1CHX^2R^2$ (1)

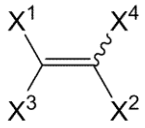
wherein X^1 and X^2 are the same or different and each is a fluorine atom, and R^1 and R^2 are the same or different and each is an alkyl group or a fluoroalkyl group; the method comprising:

(IB) reacting a cycloalkane compound represented by formula (3):



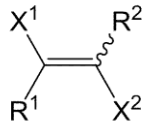
(3)

wherein R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} are the same and each is a fluorine atom, or a fluoroalkyl group; and an alkene compound represented by formula (4):



(4)

wherein X^1 and X^2 are as defined above, and X^3 and X^4 are the same or different and each is a fluorine atom; to obtain a mixture comprising a cycloalkene compound represented by formula (2):



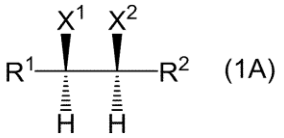
(2)

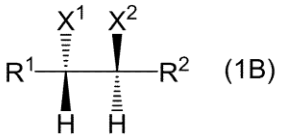
wherein X^1, X^2, R^1, and R^2 are as defined above; and the cycloalkane compound represented by formula (3); and

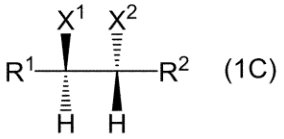
(IIB) reacting the mixture obtained in step (IB) and a hydrogen-containing gas in the presence of a catalyst to hydrogenate the cycloalkene compound represented by formula (2).

[0036c]

In another aspect, there is provided a composition comprising 3 alkane compounds represented by formulas (1A), (1B), and (1C):


(1A)


(1B)


(1C)

wherein X^1 and X^2 are the same or different and each is a fluorine atom, a bromine atom, or an iodine atom, and R^1 and R^2 are the same or different and each is an alkyl group or a fluoroalkyl group; and

the alkane compound represented by formula (1A) being contained in an amount of 20 to 80 mol%, the alkane compound represented by formula (1B) being contained in an amount of 10 to 40 mol%, and the alkane compound represented by formula (1C) being contained in an amount of 10 to 40 mol%, based on the total amount of the composition, which is taken as 100 mol%.

Advantageous Effects of Invention

[0037]