CLAIMS

1. An etching gas comprising:

fluorobutene represented by a general formula $C_4H_xF_y$, in which x is 1 or more and 7 or less, y is 1 or more and 7 or less, and x + y is 8, wherein

the etching gas contains at least one of copper, zinc, manganese, cobalt, and silicon as metal impurities, and a sum of concentrations of copper, zinc, manganese, cobalt, and silicon is 5000 ppb by mass or less.

2. The etching gas according to claim 1, wherein

the etching gas further contains at least one of alkali metals and alkaline earth metals as the metal impurities, and

a total sum of concentrations of copper, zinc, manganese, cobalt, and silicon, and alkali metals and alkaline earth metals is 10000 ppb by mass or less.

3. The etching gas according to claim 2, wherein the alkali metal is at least one of lithium, sodium, and potassium, and the alkaline earth metal is at least one of magnesium and calcium.

4. The etching gas according to any one of claims 1 to 3, wherein the fluorobutene is at least one selected from 1,1,1,4,4,4-hexafluoro-2-butene, 1,1,1,2,4,4,4-heptafluoro-2-butene, 3,3,4,4,4-

pentafluoro-1-butene, and 2,3,3,4,4,4-hexafluoro-1-butene.

5. An etching method comprising:

an etching step of bringing the etching gas according to any one of claims 1 to 4 into contact with a member to be etched having an etching object which is an object to be etched by the etching gas and a non-etching object which is not an object to be etched by the etching gas, and selectively etching the etching object as compared with the non-etching object, wherein

the etching object contains silicon.

6. The etching method according to claim 5, comprising:

before the etching step, a metal impurity removing step of setting the sum of the concentrations of copper, zinc, manganese, cobalt, and silicon contained in the etching gas to 5000 ppb by mass or less.

7. The etching method according to claim 5 or 6, wherein the etching gas is a gas containing only the fluorobutene or a mixed gas containing the fluorobutene and a dilution gas.

8. The etching method according to claim 7, wherein the dilution gas is at least one selected from a

nitrogen gas, helium, argon, neon, krypton, and xenon.

9. A method for producing a semiconductor device using the etching method according to any one of claims 5 to 8,

the member to be etched being a semiconductor substrate having the etching object and the non-etching object, and the method comprising:

a treatment step of removing at least a part of the etching object from the semiconductor substrate by the etching.