

trifluoromethyl iodide, and can be produced by a conventionally known method. For example, it is feasible according to Patent Document 3 to obtain CF_3I by reacting an iodine source selected from the group consisting of hydrogen iodide, iodine and iodine monochloride with a reactant of the formula: CF_3R (where R is selected from the group consisting of $-\text{SH}$, $-\text{S}-\text{S}-\text{CF}_3$, $-\text{S}$ -phenyl and $-\text{S}-\text{S}-(\text{CH}_3)_3$) in the presence of a metal salt catalyst.

[0018] Examples of the C2-C3 fluorine-containing linear nitrile compound used in the present embodiment include $\text{CH}_2\text{FC}\equiv\text{N}$, $\text{CHF}_2\text{C}\equiv\text{N}$, $\text{CF}_3\text{C}\equiv\text{N}$, $\text{CH}_2\text{FCF}_2\text{C}\equiv\text{N}$, $\text{CHF}_2\text{CF}_2\text{C}\equiv\text{N}$, $\text{CF}_3\text{CF}_2\text{C}\equiv\text{N}$ and the like. Among others, $\text{CF}_3\text{C}\equiv\text{N}$ and $\text{CF}_3\text{CF}_2\text{C}\equiv\text{N}$ are preferred. A sufficient metal contamination suppressing effect is recognized when the amount of the C2-C3 fluorine-containing linear nitrile compound added relative to the CF_3I is higher than or equal to 1 vol. ppm.

[0019] On the other hand, attention is now given to the factor having an influence on the etching characteristics. Patent Document 1 suggests the possibility that a trace amount of impurity contained in the CF_3I may serve as a source of generation of radical species other than intended radical species and thereby cause an effect on the etching characteristics, but discloses that the etching characteristics are not largely influenced by such a trace amount of impurity. However, too large amount of impurity causes some influence on the etching performance of the CF_3I . Thus, the amount of the fluorine-containing linear nitrile compound added is preferably lower than or equal to 1 vol% (10000 vol. ppm), more preferably lower than or equal to 0.1 vol% (1000 vol. ppm). In another embodiment of the present disclosure, it is conceivable to previously seal the C2-C3 fluorine-containing linear nitrile compound in a container and perform passivation treatment on an inner surface of the container.

[0020] The silicon oxide is represented by the chemical formula: SiO_x (where x is greater than or equal to 1 and smaller than or equal to 2). A typical example of the silicon oxide is SiO_2 . The silicon nitride is represented by the chemical formula: SiN_x (where x is greater than or equal to 0.3 and smaller than or equal to 9). A typical example of the silicon nitride is Si_3N_4 .

[0021] As a storage container of the CF_3I , there is used any closed container capable of sealing therein a gas-liquid mixture at a pressure higher than or equal to atmospheric pressure. The storage container of the CF_3I does not require a special structure and

[0028] The concentration of the inert gas is preferably 0 to 98 mass%, more preferably 5 to 80 mass%, still more preferably 30 to 50 vol%, based on the total amount of the mixed gas, the additive gas and the inert gas.

[0029] The etching method according to the present embodiment can be carried out under various dry etching conditions. Further, various additives and inert gases can be added so as to achieve a desired etching rate, etching selectivity and etching shape. As the additive gas, at least one kind of gas selected from the group consisting of O₂, O₃, CO, CO₂, COCl₂, COF₂, CF₂(OF)₂, CF₃OF, NO₂, NO, F₂, NF₃, Cl₂, Br₂, I₂ and YF_n (where Y is Cl, Br or I; and n is an integer satisfying $1 \leq n \leq 7$) is usable. In order to obtain a desired etching shape and etching rate, the etching step may be performed by using as the additive gas at least one kind of gas selected from reducing gases, fluorocarbons, hydrofluorocarbons and halogen-containing compounds (for example, at least one kind of gas selected from the group consisting of H₂, HF, HI, HBr, HCl, NH₃, CF₄, CF₃H, CF₂H₂, CFH₃, C₂F₆, C₂F₄H₂, C₂F₅H, C₃F₈, C₃F₇H, C₃F₆H₂, C₃F₅H₃, C₃F₄H₄, C₃F₃H₅, C₃F₅H, C₃F₃H, C₃ClF₃H, C₄F₈, C₄F₆, C₅F₈, C₅F₁₀, C₃F₆, C₃HF₅, C₃H₂F₄ and C₃H₃F₃). As the inert gas, N₂, Fe, Ar, Ne, Kr and Xe are usable.

[0030] The etching method according to the present embodiment can be carried out by various etching processes, such as capacitively coupled plasma (CCP) etching, reactive ion etching (RIE), inductively coupled plasma (ICP) etching, electron cyclotron resonance (ECR) plasma etching and microwave etching, with no particular limitations.

[0031] It is feasible to individually introduce the gas components of the dry etching agent into a chamber, or feasible to mix the gas components of the dry etching agent in advance at a stage downstream of the storage container and introduce the resulting mixed gas into a chamber. The total amount of the dry etching agent introduced into the reaction chamber is set as appropriate according to the capacity of the reaction chamber and the gas discharge performance of gas discharge equipment in consideration of the aforementioned concentration conditions and the undermentioned pressure conditions.

[0032] In order to obtain a stable plasma and to increase ion straightness and thereby suppress side etching, the pressure during the etching step is preferably 5 Pa or lower, more preferably 1 Pa or lower. When the pressure inside the chamber is too low, the amount of ionized ions becomes small so that a sufficient plasma density cannot be obtained. Thus, the pressure during the etching step is preferably 0.05 Pa or higher.