Claims

1. A substrate processing method for etching a part of silicon oxide layer formed on a surface of a substrate to leave remaining part of the silicon oxide layer on the surface of the substrate, the substrate processing method comprising:

a first step of hydrophilizing a surface of the silicon oxide layer by supplying plasma generated by activating at least one of oxygen gas and ozone gas to the surface of the silicon oxide layer through an ion trap member having a plurality of gas through holes; and

a second step of etching the part of the silicon oxide layer by supplying a processing gas which is at least one of a gaseous mixture containing a hydrogen fluoride gas and an ammonia gas and a gaseous mixture containing a compound of nitrogen, hydrogen and fluorine to the substrate and sublimating a reaction product generated by reaction between the processing gas and the silicon oxide layer.

2. The substrate processing method of claim 1, wherein in the second step, the substrate is etched by plasma obtained by activating a gaseous mixture of a nitrogen trifluoride gas or a hydrogen fluoride gas and an ammonia gas.

3. The substrate processing method of claim 1, wherein the silicon oxide layer is deposited by reaction between a raw material gas and an oxidizing gas.

4. The substrate processing method of claim 1, further comprising: before said hydrophilizing a surface of the silicon oxide layer,

annealing the silicon oxide layer; and

polishing and planarizing the silicon oxide layer.

5. The substrate processing method of claim 1, wherein, after the part of the silicon oxide layer is etched to leave the remaining part of the silicon oxide layer on the surface of the substrate, the supplying of the processing gas is stopped and a purge gas is supplied to the substrate to stop the etching.