

ABSTRACT

Provided is a method of performing high-accuracy etching of a silicon nitride film with a high selectivity to a silicon oxide film, while preventing degradation of a shape of a portion with the silicon oxide film during the etching. An etching method is a dry etching method that supplies a process gas into a process chamber to etch, without using a plasma, a film structure formed in advance on a wafer placed in the process chamber to include stacked layers of silicon oxide films and a silicon nitride film vertically sandwiched between the silicon oxide films such that an end portion of each of the stacked layers forms a sidewall of a trench or a hole, and the method includes the steps of: (a) causing a hydrogen fluoride gas to react at a predetermined temperature to form a reacting layer on the silicon nitride film; (b) causing a polar solvent gas to flow to process the reacting layer formed in the step (a); and (c) performing heating at a temperature higher than that in the step (a) in a state where the hydrogen fluoride gas is not allowed to flow, to evaporate and remove the reacting layer formed in the step (a) and processed in the step (b). The step (a), the step (b), and the step (c) are repeatedly performed a plurality of times.