

Abstract

Provided is a method of etching an etching target layer of a workpiece. The method includes forming a self-assemblable block copolymer layer containing a first polymer and a second polymer on an intermediate layer formed on the etching target layer; processing the workpiece to form a first region containing the first polymer and a second region containing the second polymer, from the block copolymer layer; after the processing the workpiece, forming a mask by etching the second region and the intermediate layer just below the second region; after the forming the mask, forming a protective film on the mask by generating plasma of a processing gas containing silicon tetrachloride gas and oxygen gas within a processing container of a plasma processing apparatus that accommodates the workpiece; and after the forming the protective film, etching the etching target layer.

Abstract

Provided is a method for etching a layer to be etched on an object to be processed. Said method involves: a step (a) for forming a self-organizing block copolymer layer, which contains a first polymer and a second polymer, on a middle layer disposed on a layer to be etched; a step (b) for processing the object to be processed so that a first region containing the first polymer and a second region containing the second polymer are formed from the block copolymer layer; a step (c) for forming a mask by etching the second region and the middle layer that is directly below the second region after step (b) for processing the object to be processed; a step (d) for forming a protective film on the mask by generating plasma of a treatment gas containing oxygen gas and silicon tetrachloride gas within a treatment container of a plasma treatment device housing the object to be processed after the step (c) for forming a mask; and a step (e) for etching the layer to be etched after the step (d) for forming a protective film.