

etching of the multilayer film is performed while protecting the wall surface or a surface of the mask by a plasma reaction product.

SUMMARY

[0006] In an aspect, there is provided an etching method for etching an etching target layer, the etching method comprising: depositing a plasma reaction product on a mask layer made of an organic film formed on the etching target layer; and etching the etching target layer after the depositing the plasma reaction product, wherein the mask layer includes a coarse region in which a plurality of openings are formed, and a dense region surrounding the coarse region, the mask layer existing more densely in the dense region than in the coarse region, the coarse region includes a first region and a second region positioned close to the dense region compared to the first region, and in the depositing the plasma reaction product, a width of the openings in the first region becomes narrower than a width of the openings in the second region. In an embodiment, the present disclosure relates to an etching method for etching an etching target layer. The etching method includes: (a) depositing a plasma reaction product on a mask layer made of an organic film formed on the etching target layer (hereinafter, referred to as “first step”); and (b) after the first step, etching the etching target layer (here, wherein after referred to as “second step”). The mask layer includes a coarse region in which a plurality of openings are formed, and a dense region surrounding the coarse region. The mask layer exists more densely in the dense region than in the coarse region. The coarse region includes a first region and a second region positioned close to the dense region compared to the first region. In the second step of the etching method, a width of the openings in the first region becomes narrower than a width of the openings in the second region.

[0007] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a flow chart illustrating an exemplary embodiment of a method for etching an etching target layer.

[0009] FIG. 2 is a cross-sectional view of an exemplary processing target object.

[0010] FIGS. 3A to 3C are plan views illustrating states of a processing target