generation. However despite being chemically inert with respect to F, the YOF coating as well can undergo degradation due to the deposition of fluorocarbon polymer layers

by the adsorption of fluorocarbon radicals on the YOF surface. Among other drawbacks these layers influence the etching processes and can produce large and uncontrolled shifts.

Thus, there is a need for an improved coating having superior plasma etch-resistance and offering high-level of process stability and reproducibility for the production of integrated circuits. In many cases seasoning and conditioning is used to improve such stability and reproducibility. However, this can be time consuming and can heavily increase the cost of production.

The present disclosure has the objective to solve the problem as described above and to provide an improved coating for process chamber parts, having a superior plasma etch-resistance and offering high-level of process stability and reproducibility for fluorine plasma based etch processes for the production of semiconductor devices. The present disclosure has as well the objective to provide a method for producing such an improved coating.

According to the present disclosure the problem is solved by an article comprising a substrate, and a protective film overlaying at least part of the substrate, the film comprising a fluorinated metal oxide, containing one or more elements of the Group III and/or Group IV elements of the periodical system of elements, characterized in that the protective film comprises the fluorinated metal oxide with a carbon doping with a carbon concentration not lower than 0.1at% and not higher than 10at%, preferably not lower than 0.5at% and more preferably not higher than 2.5at%, wherein the article is a plasma etch chamber component and/or part and preferably an article of the group formed by electrostatic chuck, a ring, a process kit ring, a single ring, a chamber wall, a shower head, a nozzle, a lid, a liner, a window, a baffle or a fastener. The article may preferably be formed as a vacuum compatible plasma etch chamber article, comprising a vacuum compatible substrate. The dependent claims describe further and preferred examples of the present disclosure.

According to an aspect of the present disclosure, there is provided an article comprising a substrate, and a protective film overlaying at least part of the substrate, the film consisting of a fluorinated metal oxide, containing one or more elements of the Group III and/or Group IV elements of the periodical system of elements, characterized in that the protective film consists of the fluorinated metal oxide with a carbon doping with a carbon concentration not lower than 0.1at% and not higher than 10at%, preferably not lower than 0.5at% and more preferably not higher than 2.5at%, wherein the article is a plasma etch chamber component and/or part and preferably an article of the group formed by electrostatic chuck, a ring, a process kit ring, a single ring, a chamber wall, a shower head, a nozzle, a lid, a liner, a window, a baffle or a fastener.

According to the present disclosure, the article comprises an improved coating, wherein the improved coating may be formed as a thin film comprising fluorinated metal oxide, wherein the thin film in addition comprises carbon with a concentration being in the range from 0.1 at% to 10 at%, preferably between 0.5at% and 2.5at%. The metal of the fluorinated metal oxide may be one or more element of the group III and or group IV elements of the periodical system. More preferably the metal may contain Yttrium or may be Yttrium.

According to another example, the protective film may comprise a gradient layer with increasing fluorine concentration measured from a deeper part of the protective film to a less deep part of the protective film and/or the protective film may be a multilayer

Claims

1. An article comprising

- a substrate

- a protective film overlaying at least part of the substrate, the film consisting of a fluorinated metal oxide, containing one or more elements of the Group III and/or Group IV elements of the periodical system of elements, characterized in that the protective film consists of the fluorinated metal oxide with a carbon doping with a carbon concentration not lower than 0.1at% and not higher than 10at%, preferably not lower than 0.5at% and more preferably not higher than 2.5at%, wherein the article is a plasma etch chamber component and/or part and preferably an article of the group formed by electrostatic chuck, a ring, a process kit ring, a single ring, a chamber wall, a shower head, a nozzle, a lid, a liner, a window, a baffle or a fastener.

2. Article according to claim 1, characterized in that the metal of the protective film contains Yttrium and preferably is Yttrium.

3. Article according to one of the claims 1 or 2, characterized in that the protective film has a coating thickness not less than 0.1 µm and not more than 30 µm.

4. Article according to one of the preceding claims, characterized in that the protective film has a roughness of Ra < 1 µm, preferably, Ra < 0.25 µm, most preferably Ra < 0.025 µm.

5. Article according to one of the preceding claims, characterized in that the protective film has a reduced peak height of Rpk < 0.25 µm, preferably Rpk < 0.10 µm, most preferably Rpk < 0.025 µm.

6. Article according to one of the preceding claims, characterized in that the protective film has a hardness of at least 10 GPa as determined by nanoindentation with a fixed load of 5mN, while the indentation depth is maintained below 10% of the coating thickness.

7. Article according to one of the preceding claims, characterized in that between the protective film and the substrate is an adhesion-promoting layer being a second metal or second metal oxide, where the metal of the film and second metal are preferably identical.

8. Article according to one of the preceding claims, characterized in that the protective film comprises a gradient layer with increasing fluorine concentration measured from a deeper part of the protective film to a less deep part of the protective film and/or the protective film is a multilayer system comprising at least two layers with different fluorine concentrations with the fluorine concentration in the layer more distant to the substrate being higher than the fluorine concentration in the layer closer to the substrate.

9. Article according to one of the preceding claims, characterized in that the protective film comprises a gradient layer starting close to the substrate from pure M203 to MaObFcCd, wherein M represents one or more elements of the Group III and/or Group IV elements of the periodical system of elements, in which the concentration of MaObFcCd are preferably chosen as follows: $0.25 < a < 0.4$, $0.2 < b < 0.6$, $0.1 < c < 0.6$ and $0.01 < d < 0.1$ with $a+b+c+d = 1$.

10. Article according to one of the preceding claims, characterized in that between the protective film or if given the adhesion promoting layer and the substrate foreseen is a Y-containing thermally sprayed precoat, preferably comprising Y_2O_3 and/or YOF.

11. Method for producing an article according to one of the preceding claims, characterized in that the protective film overlaying at least a part of the substrate is applied by Physical Vapor Deposition (PVD) and/or Chemical Vapor Deposition (CVD).