

[DESCRIPTION]

[Title]

METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE, SUBSTRATE
PROCESSING APPARATUS AND NON-TRANSITORY COMPUTER-READABLE
5 RECORDING MEDIUM

[Technical Field]

[0001]

The present invention relates to a method of manufacturing a semiconductor
device, a substrate processing apparatus and a non-transitory computer-readable
10 recording medium.

[Related Art]

[0002]

As one of manufacturing processes of a semiconductor device, a substrate
processing of processing a film formed on a surface of a substrate by supplying a
15 process gas containing hydrogen peroxide to the substrate may be performed (refer to,
for example, patent documents 1 and 2).

[Related Art Document]

[Patent Document]

[0003]

20 Patent Document 1: International Publication No. 2014/069826
Patent Document 2: International Publication No. 2013/070343

[Disclosure]

[Technical Problem]

[0004]

25 It is an object of the present invention to provide a technique capable of
improving the quality of an oxide film processed using hydrogen peroxide.

[Technical Solution]

[0005]

gas such as ammonia (NH₃) gas described later is constituted mainly by the second gas supply pipe 232b, the MFC 241b and the valve 243b. The second process gas supply system may further include the second process gas supply source 251b.

[0021]

5 An exhaust pipe 231 configured to exhaust an inner atmosphere of the process chamber 201 is connected to a lower portion of the side wall of the reaction tube 203. A vacuum pump 246 serving as a vacuum exhausting apparatus is connected to the exhaust pipe 231 through a pressure sensor 245 and an APC (Automatic Pressure Controller) valve 244. The pressure sensor 245 serves as a pressure detector configured
10 to detect an inner pressure of the process chamber 201, and the APC valve 244 serves as a pressure adjustment device. With the vacuum pump 246 in operation, the APC valve 244 may be opened or closed to vacuum-exhaust the process chamber 201 or stop the vacuum exhaust. With the vacuum pump 246 in operation, an opening degree of the APC valve 244 may be adjusted based on pressure information detected by the pressure
15 sensor 245, in order to adjust the inner pressure of the process chamber 201. An exhaust system is constituted mainly by the exhaust pipe 231, the APC valve 244 and the pressure sensor 245. The exhaust system may further include the vacuum pump 246.

[0022]

 As shown in FIG. 2, a controller 121 serving as a control device is constituted by
20 a computer including a CPU (Central Processing Unit) 121a, a RAM (Random Access Memory) 121b, a memory device 121c and an I/O port 121d. The RAM 121b, the memory device 121c and the I/O port 121d may exchange data with the CPU 121a through an internal bus 121e. For example, an input/output device 122 such as a touch panel is connected to the controller 121.

25 [0023]

 The memory device 121c is configured by components such as a flash memory and a hard

coated film filled in at least the groove according to the prebaking step. Therefore, in particular, a thickness of the polysilazane film formed in the groove is equal to or greater than a depth of the groove. For example, the thickness of the polysilazane film is 4 μm or more.

5 [0032]

(2-2) Substrate Processing

Subsequently, an example of the substrate processing performed using the substrate processing apparatus described above will be described with reference to FIG. 4. Hereinafter, the operations of the components constituting the substrate processing
10 apparatus are controlled by the controller 121.

[0033]

<Substrate Loading Step>

The plurality of the wafers including the wafer 200 with the polysilazane film formed on the surface thereof by the pre-processing step is loaded (charged) into the
15 boat 217. After the boat 217 is charged with the plurality of the wafers, the boat 217 accommodating the plurality of the wafers is elevated by the boat elevator 115 and loaded into the process chamber 201 as shown in FIG. 1. With the boat 217 loaded, the seal cap 219 seals the lower end opening of the reaction tube 203.

[0034]

20 <Pressure and Temperature Adjusting Step>

First, the process chamber 201 in which the plurality of the wafers including the wafer 200 is accommodated is vacuum-exhausted to, for example, about 1 Pa by the vacuum pump 246. Thereafter, the valve 243c is opened to supply the O_2 gas serving as the oxygen-containing gas into the process chamber 201 through the second gas supply
25 port 242c while a flow rate of the O_2 gas is adjusted by the MFC 241c. While supplying the O_2 gas, the inner pressure of the process chamber 201 is measured by the pressure sensor 245, and the APC valve 244 is feedback-controlled based on the measured pressure information such that the inner pressure of the process chamber reaches a