WHAT IS CLAIMED IS:

1. A decompression processing apparatus for processing a wafer in a decompressed state, the decompression processing apparatus comprising:

a holding table configured to hold the wafer;

a decompression chamber in which the holding table is disposed, the decompression chamber having an exhaust port;

an opening and closing door configured to open and close a carrying-in-and-out opening through which the wafer is carried into and carried out of the decompression chamber;

a reactant gas supply source for supplying reactant gas to the decompression chamber and a first supply valve;

an inert gas source for supplying an inert gas to the decompression chamber and a second supply valve;

decompressing means connected to the exhaust port for exhausting the inert gas from the decompression chamber; and

a processor programmed to maintain a positive pressure in the decompression chamber with respect to an outside air by supplying the inert gas to an inside of the decompression chamber by opening the second supply valve and closing the exhaust port, the opening and closing door being opened, and the inside of the decompression chamber being maintained in a dry state by continuing to supply the inert gas to the inside of the decompression chamber by the inert gas source until the opening and closing door is closed, the exhaust port being then opened to exhaust the inert gas.