

CLAIMS:

[Claim 1] A surface treatment apparatus which applies a hydrophilic treatment to a bonding surface of a target object bonded to a bonded object using hydrogen bonding, the hydrophilic treatment being applied prior to the bonding, the surface treatment apparatus
5 comprising:

a support base which supports a surface of the target object opposite to the bonding surface, the target object being one or more target objects; and

a spray nozzle which causes dew condensation temporarily on the bonding surface by spraying, onto the bonding surface of the target object supported by the support base, humidified
10 air having a water vapor pressure equal to or higher than a saturated water vapor pressure corresponding to a temperature of the bonding surface, wherein

the support base further comprises a cooler which cools the temperature of the bonding surface to a temperature lower than a temperature of an ambient atmosphere and higher than a dew point temperature of a water vapor pressure of the ambient atmosphere,

15 the one or more target objects are placed on the support base with their periphery being surrounded by a frame member, and

the cooler cools the one or more target objects, and the frame member has a position and a size at which the frame member is not cooled.

[Claim 2] The surface treatment apparatus according to claim 1, wherein

20 the spray nozzle is movable with respect to the support base while spraying the humidified air.

[Claim 3] The surface treatment apparatus according to claim 1, wherein

the spray nozzle has a spray area covering all of the one or more target objects.

[Claim 4] The surface treatment apparatus according to any one of claims 1 to 3, wherein

25 the target object is a chip which is a semiconductor integrated circuit or a wafer to which

the chip is bonded.

[Claim 5] A manufacturing apparatus for a semiconductor device, which manufactures a semiconductor device by bonding a chip, which is a semiconductor integrated circuit, to a wafer using hydrogen bonding, the manufacturing apparatus for a semiconductor device comprising:

5 a bonding unit which bonds the chip to a top surface of the wafer or another chip mounted on the wafer; and

 one or more surface treatment apparatuses according to claim 1, wherein the target object is the chip or the wafer.

[Claim 6] The manufacturing apparatus for a semiconductor device according to claim 5,

10 wherein

 the spray nozzle is movable with respect to the target object.