

CLAIMS

1. A method for manufacturing a semiconductor device, comprising at least:

a step (A) of preparing a structure including a semiconductor wafer having a circuit-formed surface and an adhesive film attached to the circuit-formed surface side of the semiconductor wafer;

a step (B) of back grinding a surface on a side opposite to the circuit-formed surface side of the semiconductor wafer; and

a step (C) of radiating ultraviolet rays to the adhesive film and then removing the adhesive film from the semiconductor wafer,

wherein, as the adhesive film, an adhesive film including a base material layer and an ultraviolet-curable adhesive resin layer provided on one surface side of the base material layer,

the adhesive resin layer including an ultraviolet-curable adhesive resin, and

a saturated electrostatic potential V_1 of the adhesive resin layer surface after ultraviolet curing, which is measured using a method described below, being equal to or less than 2.0 kV is used,

wherein a tack force of the surface of the adhesive resin layer after ultraviolet curing, which is measured using a method described below, is equal to or less than 0.1 N/cm^2 ,

(method)

ultraviolet rays having a main wavelength of 365 nm are radiated to the adhesive resin layer using a high-pressure mercury lamp in an environment of 25°C at a radiation intensity of 100 mW/cm^2 and an ultraviolet amount of $1,080 \text{ mJ/cm}^2$, thereby photocuring the

adhesive resin layer, and then a voltage is applied to a surface of the adhesive layer for 30 seconds under conditions of an applied voltage of 10 kV, a distance between a specimen and electrodes of 20 mm, 25°C, and 50%RH, and the saturated electrostatic potential (V_1) of the surface of the adhesive resin layer is computed according to JIS L1094,

(method)

ultraviolet rays having a main wavelength of 365 nm are radiated to the adhesive resin layer using a high-pressure mercury lamp in an environment of 25°C at a radiation intensity of 100 mW/cm² and an ultraviolet amount of 1,080 mJ/cm², thereby photocuring the adhesive resin layer, and then the tack force of the surface of the adhesive resin layer is measured using a method in which, using a probe tack tester as a measurement instrument, a probe having a diameter of 5 mm and the surface of the adhesive resin layer are brought into contact with each other at a rate of 10 mm/second and held in contact with each other at a contact load of 0.98 N/cm² for 10 seconds, and then the probe is peeled off from the surface of the adhesive resin layer in a vertical direction at a rate of 10 mm/second.

2. A method for manufacturing a semiconductor device, comprising at least:

a step (A) of preparing a structure including a semiconductor wafer having a circuit-formed surface and an adhesive film attached to the circuit-formed surface side of the semiconductor wafer;

a step (B) of back grinding a surface on a side opposite to the circuit-formed surface side of the semiconductor wafer; and

a step (C) of radiating ultraviolet rays to the adhesive film and then removing the adhesive film from the semiconductor wafer,

wherein, as the adhesive film, an adhesive film including a base material layer and an ultraviolet-curable adhesive resin layer provided on one surface side of the base material layer,

the adhesive resin layer including an ultraviolet-curable adhesive resin, and

a saturated electrostatic potential V_1 of the adhesive resin layer surface after ultraviolet curing, which is measured using a method described below, being equal to or less than 2.0 kV is used,

wherein, when a saturated electrostatic potential of the surface of the adhesive resin layer after ultraviolet curing, which is measured using a method described below, is represented by V_2 , V_1/V_2 is equal to or less than 5.0,

(method)

ultraviolet rays having a main wavelength of 365 nm are radiated to the adhesive resin layer using a high-pressure mercury lamp in an environment of 25°C at a radiation intensity of 100 mW/cm² and an ultraviolet amount of 1,080 mJ/cm², thereby photocuring the adhesive resin layer, and then a voltage is applied to a surface of the adhesive layer for 30 seconds under conditions of an applied voltage of 10 kV, a distance between a specimen and electrodes of 20 mm, 25°C, and 50%RH, and the saturated electrostatic potential (V_1) of the surface of the adhesive resin layer is computed according to JIS L1094,

(method)

ultraviolet rays having a main wavelength of 365 nm are radiated

to the adhesive resin layer using a high-pressure mercury lamp in an environment of 25°C at a radiation intensity of 100 mW/cm² and an ultraviolet amount of 200 mJ/cm², thereby photocuring the adhesive resin layer, and then a voltage is applied to the surface of the adhesive resin layer for 30 seconds under conditions of an applied voltage of 10 kV, a distance between a specimen and electrodes of 20 mm, 25°C, and 50%RH, and the saturated electrostatic potential (V_2) of the surface of the adhesive resin layer is computed according to JIS L1094.

3. The method for manufacturing a semiconductor device according to Claim 2,

wherein a tack force of the surface of the adhesive resin layer after ultraviolet curing, which is measured using a method described below, is equal to or less than 0.1 N/cm²,

(method)

ultraviolet rays having a main wavelength of 365 nm are radiated to the adhesive resin layer using a high-pressure mercury lamp in an environment of 25°C at a radiation intensity of 100 mW/cm² and an ultraviolet amount of 1,080 mJ/cm², thereby photocuring the adhesive resin layer, and then the tack force of the surface of the adhesive resin layer is measured using a method in which, using a probe tack tester as a measurement instrument, a probe having a diameter of 5 mm and the surface of the adhesive resin layer are brought into contact with each other at a rate of 10 mm/second and held in contact with each other at a contact load of 0.98 N/cm² for 10 seconds, and then the probe is peeled off from the surface of the adhesive resin layer

in a vertical direction at a rate of 10 mm/second.

4. The method for manufacturing a semiconductor device according to any one of Claims 1 to 3,

wherein, in the step (C), ultraviolet rays having a radiation dose of equal to or more than 350 mJ/cm^2 are radiated to the adhesive film, whereby the adhesive resin layer is photocured, and an adhesive force of the adhesive resin layer is decreased, and then the adhesive film is removed from the semiconductor wafer.

5. The method for manufacturing a semiconductor device according to any one of Claims 1 to 4,

wherein a bump electrode is formed on the circuit-formed surface of the semiconductor wafer.

6. The method for manufacturing a semiconductor device according to any one of Claims 1 to 5,

wherein a half-life of the saturated electrostatic potential V_1 is equal to or shorter than 100 seconds.

7. The method for manufacturing a semiconductor device according to any one of Claims 1 to 6,

wherein a thickness of the adhesive resin layer is equal to or more than $5 \text{ }\mu\text{m}$ and equal to or less than $550 \text{ }\mu\text{m}$.

8. The method for manufacturing a semiconductor device according to any one of Claims 1 to 7,

wherein the adhesive resin layer has an antistatic layer and an adhesive layer in this order from the base material layer side.

9. The method for manufacturing a semiconductor device according to Claim 8,

wherein the antistatic layer includes a conductive polymer.

10. The method for manufacturing a semiconductor device according to Claim 8 or 9,

wherein the adhesive layer includes an ultraviolet-curable adhesive resin and an ionic additive.

11. The method for manufacturing a semiconductor device according to any one of Claims 8 to 10,

wherein the adhesive resin layer further has an unevenness-absorbing resin layer between the base material layer and the antistatic layer.

12. The method for manufacturing a semiconductor device according to any one of Claims 8 to 11,

wherein a thickness of the adhesive layer is less than 30 μm .

13. The method for manufacturing a semiconductor device according to any one of Claims 8 to 10,

wherein the adhesive resin layer further has an unevenness-absorbing resin layer between the base material layer and the antistatic layer, and a thickness of the adhesive layer is less

than 30 μm .

14. The method for manufacturing a semiconductor device according to any one of Claims 8 to 13,

wherein a thickness of the antistatic layer is equal to or more than 0.01 μm and equal to or less than 10 μm .

15. The method for manufacturing a semiconductor device according to any one of Claims 1 to 14,

wherein the ultraviolet-curable adhesive resin includes a (meth)acrylic adhesive resin having a photopolymerizable carbon-carbon double bond in a molecule.