CLAIMS

1. A rinsing liquid for use in removal of at least a part of sealing layer for a semiconductor that is formed in a sealing composition application process in a method for manufacturing a semiconductor device, the rinsing liquid having a pH at 25°C of 6 or lower,

wherein the rinsing liquid comprises a compound having, in one molecule thereof, a moiety A that blocks an active species and a moiety B that forms a bond with the polymer when heated, the moiety A is at least one selected from the group consisting of an aromatic ring structure, an alicyclic structure, and a manganese atom, and the moiety B is a carboxyl group,

wherein the method for manufacturing a semiconductor device comprising:

a sealing composition application process of applying a sealing composition for a semiconductor to at least a bottom face and a side face of a recess portion of a semiconductor substrate, to form a sealing layer for a semiconductor on at least the bottom face and the side face of the recess portion, the sealing composition for a semiconductor including a polymer having a cationic functional group and a weight average molecular weight of from 2,000 to 1,000,000, each of the content of sodium and the content of potassium in the sealing composition for a semiconductor being 10 ppb by mass or less on an elemental basis, and the semiconductor substrate being provided with an interlayer insulating layer having the recess portion and a copper-containing wiring of which at least a part of a surface thereof is exposed on at least a part of the bottom face of the recess portion; and

a removal process of subjecting a surface of the semiconductor substrate at a side at which the sealing layer for a semiconductor has been formed to heat treatment under a temperature condition of from 200°C to 425°C, to remove at least a part of the sealing layer for a semiconductor that has been formed on an exposed face of the wiring.

2. The rinsing liquid according to claim 1, wherein the polymer has a cationic functional group equivalent weight of from 27 to 430.

3. A rinsing liquid for a sealing layer for a semiconductor, the sealing layer being formed on a surface of an interlayer insulating layer of a semiconductor substrate that includes the interlayer insulating layer, and being derived from a polymer having a cationic functional group and a weight average molecular weight of from 2,000 to 1,000,000,

wherein the rinsing liquid comprises a compound having, in one molecule thereof, a moiety A that blocks an active species and a moiety B that forms a bond with the polymer

when heated, the moiety A is at least one selected from the group consisting of an aromatic ring structure, an alicyclic structure, and a manganese atom, and the moiety B is a carboxyl group.

4. The rinsing liquid according to claim 3, wherein the compound has, in one molecule thereof, two or more carboxyl groups as the moiety B, and

wherein the compound has, in one molecule thereof, at least one of a structure in which each of two neighboring carbon atoms bonds to a carboxyl group or a structure in which each of two non-central carbon atoms from among three consecutive carbon atoms bonds to a carboxyl group.

Claims

1. A rinsing liquid for use in removal of at least a part of the sealing layer for a semiconductor that is formed in the sealing composition application process in the method for manufacturing a semiconductor device according to claim 1 or 2, the rinsing liquid having a pH at 25°C of 6 or lower,

wherein the rinsing liquid comprises a compound having, in one molecule thereof, a moiety A that blocks an active species and a moiety B that forms a bond with the polymer when heated, the moiety A is at least one selected from the group consisting of an aromatic ring structure, an alicyclic structure, and a manganese atom, and the moiety B is a carboxyl group.

2. A rinsing liquid for a sealing layer for a semiconductor, the sealing layer being formed on a surface of an interlayer insulating layer of a semiconductor substrate that includes the interlayer insulating layer, and being derived from a polymer having a cationic functional group and a weight average molecular weight of from 2,000 to 1,000,000,

wherein the rinsing liquid comprises a compound having, in one molecule thereof, a moiety A that blocks an active species and a moiety B that forms a bond with the polymer when heated, the moiety A is at least one selected from the group consisting of an aromatic ring structure, an alicyclic structure, and a manganese atom, and the moiety B is a carboxyl group.

3. The rinsing liquid according to claim 9, wherein the compound has, in one molecule thereof, two or more carboxyl groups as the moiety B, and

wherein the compound has, in one molecule thereof, at least one of a structure in which each of two neighboring carbon atoms bonds to a carboxyl group or a structure in which each of two non-central carbon atoms from among three consecutive carbon atoms bonds to a carboxyl group.

4. A semiconductor device comprising, on a semiconductor substrate:

an interlayer insulating layer having a recess portion;

a first wiring that includes copper, and that is formed on the recess portion;

a sealing layer for a semiconductor that is present at least between a side face of the recess portion of the interlayer insulating layer and the first wiring, and that includes a polymer

having a cationic functional group and a weight average molecular weight of from 2,000 to 1,000,000; and

a second wiring that contains copper, that has an upper face constituting at least a part of a bottom face of the recess portion, and that is electrically connected to the first wiring via the upper face,

wherein a thickness of the sealing layer for a semiconductor in a connection portion between the first wiring and the second wiring is 5 nm or less,

wherein the sealing layer for a semiconductor includes at least one selected from the group consisting of an imide bond and an amide bond, and also includes at least one selected from the group consisting of an aromatic ring structure and a manganese atom.

5. A semiconductor device comprising, on a semiconductor substrate:

an interlayer insulating layer;

a first wiring that includes copper; and

a sealing layer for a semiconductor that is present between the interlayer insulating layer and the first wiring, and that includes a polymer having a cationic functional group and a weight average molecular weight of from 2,000 to 1,000,000,

wherein the sealing layer for a semiconductor includes at least one selected from the group consisting of an imide bond and an amide bond, and also includes at least one selected from the group consisting of an aromatic ring structure and a manganese atom.

6. The semiconductor device according to claim 4 or 5, wherein the polymer has a cationic functional group equivalent weight of from 27 to 430.

7. The semiconductor device according to claim 4 or 5, wherein the polymer is polyethyleneimine or a polyethyleneimine derivative.

8. The semiconductor device according to claim 4 or 5, wherein the interlayer insulating layer is a porous interlayer insulating layer having an average pore radius of from 0.5 nm to 3.0 nm.