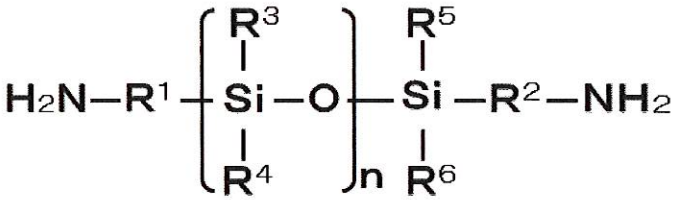
[0008]

That is, in a first aspect, there is provided a temporary-bonding adhesive, wherein the temporary-bonding adhesive is a polyimide copolymer having at least an acid dianhydride residue and a diamine residue, the diamine residue includes both of (A1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 1 to 15, and (B1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100, and the polyimide copolymer contains 40 to 99.99 mol% of the (A1) residue and 0.01 to 60 mol% of the (B1) residue:

[0009]



(1)

[0010]

in which n is a natural number, R^1 and R^2 may be the same or different and represent an alkylene group having 1 to 30 carbon atoms or a phenylene group, and R^3 to R^6 may be the same or different and represent an alkyl group having 1 to 30 carbon atoms, a phenyl group, or a phenoxy group.

In another embodiment, there is provided a temporary-bonding adhesive, wherein the temporary-bonding adhesive is a polyimide

substrate, and a step of washing, with a solvent, an adhesive layer adhering to the semiconductor circuit formation substrate de-bonded off from the wafer work piece or the support substrate of the wafer work piece.

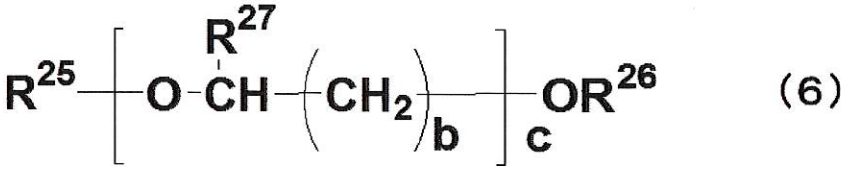
[0018a] In another aspect, there is provided a method for manufacturing a semiconductor device, wherein the step of fabricating the semiconductor circuit formation substrate into a thinner one as defined above comprises a step of fabricating a thickness of the semiconductor circuit formation substrate to at least 1 μm and at most 100 μm.

[0019]

In another embodiment, there is provided a rework solvent for cleaning the adhesive layer adhering to the de-bonded semiconductor circuit formation substrate or support substrate, wherein the rework solvent contains at least (A) an amine-based solvent and (B) a solvent represented by the general formula (6):

[0020]

[Chemical Formula 5]



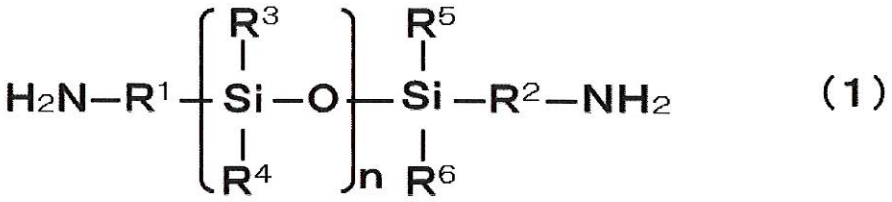
(6)

[0021]

in which R^{25} and R^{26} independently represent hydrogen, alkyl groups having 1 to 12 carbon atoms, an acetyl group, or aromatic

formula (1) in which n is a natural number of 1 to 15, and (B1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100, and the polyimide copolymer contains 40 to 99.99 mol% of the (A1) residue and 0.01 to 60 mol% of the (B1) residue:

[0022]



(1)

[0023]

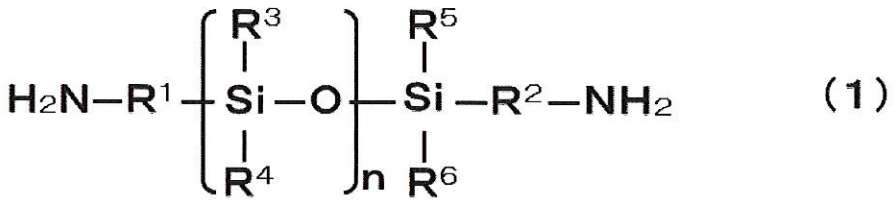
in which n is a natural number, R^1 and R^2 may be the same or different and represent an alkylene group having 1 to 30 carbon atoms or a phenylene group, and R^3 to R^6 may be the same or different and represent an alkyl group having 1 to 30 carbon atoms, a phenyl group, or a phenoxy group.

In another embodiment, there is provided a polyimide mixed resin including (A2) a polyimide and/or a precursor thereof having at least an acid dianhydride residue and a diamine residue, containing a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 1 to 15 and not containing a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100, and (B2) a polyimide and/or a precursor

thereof having at least an acid dianhydride residue and a diamine residue, containing a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100 and not containing a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 1 to 15, and the polyimide mixed resin contains 40 to 99.99 wt% of the (A2) and 0.01 to 60 wt% of the (B2):

[0024]

[Chemical Formula 7]



(1)

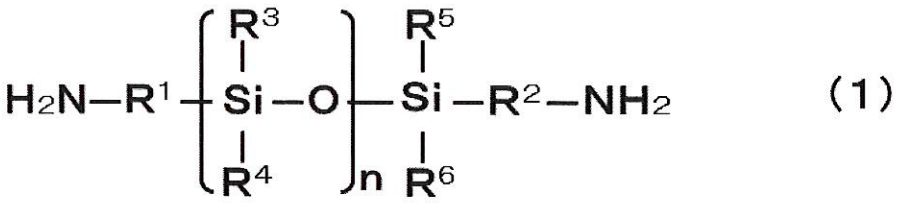
[0025]

in which n is a natural number, R^1 and R^2 may be the same or different and represent an alkylene group having 1 to 30 carbon atoms or a phenylene group, and R^3 to R^6 may be the same or different and represent an alkyl group having 1 to 30 carbon atoms, a phenyl group, or a phenoxy group.

In another embodiment, there is provided a resin composition containing (a) a resin (excluding a siloxane polymer represented by a general formula (2)), and at least one of (b-1) a siloxane polymer represented by a general formula (2) and (b-2) a compound represented by a general formula (3), wherein

CLAIMS

1. A temporary-bonding adhesive, wherein the temporary-bonding adhesive is a polyimide copolymer having at least an acid dianhydride residue and a diamine residue, the diamine residue includes both of (A1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 1 to 15, and (B1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100, and the polyimide copolymer contains 40 to 99.99 mol% of the (A1) residue and 0.01 to 60 mol% of the (B1) residue:



(1)

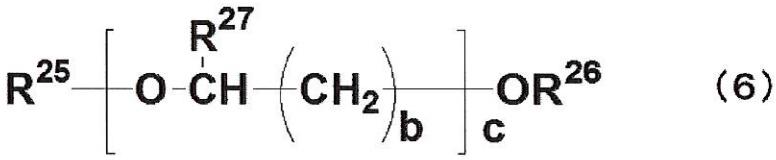
in which n is a natural number, R^1 and R^2 may be the same or different and represent an alkylene group having 1 to 30 carbon atoms or a phenylene group, and R^3 to R^6 may be the same or different and represent an alkyl group having 1 to 30 carbon atoms, a phenyl group, or a phenoxy group.

2. The temporary-bonding adhesive according to

claim 1, further comprising (c) a solvent.

3. The temporary-bonding adhesive according to claim 2, wherein the (c) solvent contains a solvent having an SP value of 7.5 to 9.0.

4. The temporary-bonding adhesive according to claim 2 or 3, wherein the (c) solvent contains a solvent represented by a general formula (6):



(6)

in which R^{25} and R^{26} independently represent hydrogen, alkyl groups having 1 to 12 carbon atoms, an acetyl group, or aromatic groups, R^{27} represents hydrogen or a methyl group, b is either 0, 1 or 2, and c is an integer of 1 to 3.

5. The temporary-bonding adhesive according to any one of claims 1 to 4, further comprising inorganic particles.

6. An adhesive layer obtained by forming a coating of the temporary-bonding adhesive according to any one of claims 1 to 5.

7. A wafer work piece formed by bonding a semiconductor circuit formation substrate to a support substrate with at least the adhesive layer according to claim 6 interposed therebetween.

8. A wafer work piece formed by bonding a semiconductor circuit formation substrate to a support substrate with the adhesive layer according to claim 6 interposed therebetween.

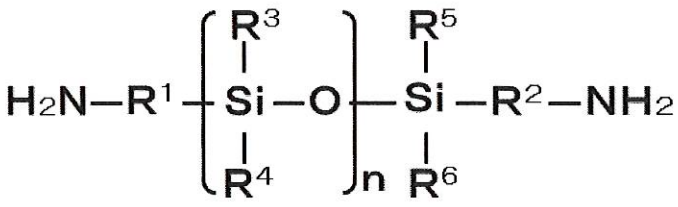
9. A method for manufacturing a semiconductor device using the wafer work piece according to claim 7 or 8 comprising at least any one of a step of fabricating the semiconductor circuit formation substrate into a thinner one, a step of subjecting the semiconductor circuit formation substrate of the wafer work piece to device processing, a step of de-bonding off the semiconductor circuit formation substrate of the wafer work piece from a support substrate, and a step of washing, with a solvent, an adhesive layer adhering to the semiconductor circuit formation substrate de-bonded off from the wafer work piece or the support substrate of the wafer work piece.

10. A method for manufacturing a semiconductor device, wherein the step of fabricating the semiconductor circuit formation substrate into a thinner one according to claim 9 comprises a step of fabricating a thickness of the semiconductor

circuit formation substrate to at least 1 μm and at most 100 μm.

11. A polyimide copolymer having at least an acid dianhydride residue and a diamine residue, wherein the diamine residue includes both of (A1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 1 to 15, and (B1) a polysiloxane-based diamine residue represented by a general formula (1) in which n is a natural number of 16 to 100, and the polyimide copolymer contains 40 to 99.99 mol% of the (A1) residue and 0.01 to 60 mol% of the

(B1) residue:



(1)

in which n is a natural number, R^1 and R^2 may be the same or different and represent an alkylene group having 1 to 30 carbon atoms or a phenylene group, and R^3 to R^6 may be the same or different and represent an alkyl group having 1 to 30 carbon atoms, a phenyl group, or a phenoxy group.