Specification

An Agent and a Method for Preventing Epoxy-Bleed-Out

Technical Field

The present invention relates to an agent and to a method for preventing epoxy-bleed-out in a die-bonding step for adhering and fixing semiconductor devices such as lead frames and printed wiring boards to IC chips with epoxy resins.

Background Art

In a die-bonding step to adhere and fix semiconductor devices such as lead frames and printed wiring boards to IC chips with epoxy resins, resins or additives bleed out upon application of epoxy resins (epoxy-bleed-out) when surface-roughness of bonding surfaces (usually plated with gold, silver, copper, palladium, etc.) is too high or when surfaces are polluted with organic substances such as discoloration preventing agents and sealing agents. The epoxy-bleed-out impairs die-bonding strength and cause defects in a subsequent wire-bonding step.

Conventionally, in order to prevent such epoxy-bleed-out, surface-roughness of bonding surfaces has been reduced to suppress a capillary action or surfaces have been washed to remove contaminants. Since surface-roughness affects die-bonding strength and image recognition capacity of assembled machines, however, it cannot be reduced depending on situations. Washing of surfaces, also

impairing effects of discoloration preventing treatment and sealing treatment, is problematic.

The present invention resides in establishment of a method for preventing epoxy-bleed-out that does not adversely affect die-bonding strength or assembly properties and that does not impair an effect of discoloration preventing treatment or that of sealing treatment.

Disclosure of the Invention

As a result of intensive research by the present inventor, it was found that epoxy-bleed-out can be easily prevented by immersing base material in a solution containing specific organic compounds and making an organic film adsorbed on the surfaces of plated planes.

Based on the finding, the present invention provides:

1. An agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process characterized in that it contains at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof;

2. A method for preventing epoxy-bleed-out characterized in that wiring base materials are immersed in the agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process containing at least one

organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof, or the agent for preventing epoxy-bleed-out is sprayed on the wiring base materials;

3. A wiring base material and a semiconductor package characterized in that they have been subjected to epoxy-bleed-out preventing treatment by immersing the wiring base material in the agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process containing at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof, or spraying the agent for preventing epoxy-bleed-out on the wiring base material;

4. A wiring base material and a semiconductor package characterized in that at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the

molecules, and derivatives thereof is adsorbed on the surfaces; and

5. A solution for preventing discoloration or for sealing treatment characterized in that it contains the agent for preventing epoxy-bleed-out comprising at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof.

Embodiments

Although the agent for preventing epoxy-bleed-out according to the present invention is applicable especially to semiconductor devices such as lead frames and printed wiring boards, its application is not limited to them and it can be applied to any products in which epoxy-bleed-out may occur during a die-bonding step.

As organic compounds that are contained in the agent for preventing epoxy-bleed-out according to the present invention and that have a function to prevent epoxy-bleed-out, the following organic compounds can be mentioned:

A: Carboxylic acids or thiols having three or more carbon atoms in the straight chain

For example, carboxylic acids such as caproic acid ($C_5H_{11}COOH$), butyric acid (C_3H_7COOH), enanthic acid ($C_6H_{13}COOH$), pelargonic acid ($C_8H_{17}COOH$), capric acid ($C_9H_{19}COOH$), undecylic

acid ($C_{10}H_{21}COOH$), lauric acid ($C_{11}H_{23}COOH$), tridecylic acid ($C_{12}H_{25}COOH$), myristic acid ($C_{13}H_{27}COOH$), pentadecylic acid ($C_{14}H_{29}COOH$), palmitic acid ($C_{15}H_{31}COOH$), heptadecylic acid ($C_{16}H_{33}COOH$), stearic acid ($C_{17}H_{35}COOH$), nonadecanoic acid ($C_{18}H_{37}COOH$), behenic acid ($C_{21}H_{43}COOH$), oleic acid ($C_{17}H_{33}COOH$), erucic acid ($C_{21}H_{41}COOH$), linoleic acid ($C_{17}H_{31}COOH$), and linolenic acid ($C_{17}H_{29}COOH$); and

thiols such as pentanethiol ($C_5H_{11}SH$), octanethiol ($C_8H_{17}SH$), decanethiol ($C_{10}H_{21}SH$), hexadecylmercaptane ($C_{16}H_{33}SH$), and mercapto-propyl methoxy silane ($HS(CH_2)_3Si(OCH_3)_3$);

B: Carboxylic acids or thiols having benzene rings:

For example, nitrobenzoic acid ($O_2NC_6H_4COOH$), benzyl mercaptane ($C_6H_5CH_2SH$), etc.:

C: Carboxylic acids having mercapto groups or hydroxy groups:

For example, mercaptoacetic acid ($HSCH_2COOH$), mucic acid ($HOOC(CHOH)_4COOH$), etc.:

D: Unsaturated polyalcohols:

For example, butynediol ($HOCH_2C{\equiv}CH_2OH$), butenediol ($HOCH_2CH{=}CHCH_2OH$), etc.; and

E: Nitrogen-containing heterocyclic compounds containing surfers in the molecule:

For example, thiobarbituric acid, etc.

An agent for preventing epoxy-bleed-out containing at least one organic compound selected from the above organic compounds and derivatives thereof is included in the present invention.

The agent for preventing epoxy-bleed-out according to the present invention contains 0.1 mg/L-100 g/L, preferably 10 mg/L-10 g/L of the above organic compounds.

If the concentration of the above organic compounds is too low, the effect of preventing epoxy-bleed-out cannot be obtained. If the concentration is too high, a higher effect cannot be expected and thus it is not preferable.

When the above organic compounds are hardly soluble in water, organic solvents such as alcohols and ketones are added, if required.

In addition, 0.1-100 g/L, preferably 1-50 g/L of boric acid-based, phosphoric acid-based, or organic acid-based pH-buffers are added, if required.

In addition, 1 μg/L-10 g/L, preferably 10 μg/L-1 g/L of anionic, cationic, and nonionic surfactants, alone or in combination, are added, if required.

It is not necessary to particularly restrict the pH of a solution of the agent for preventing epoxy-bleed-out.

The temperature of the solution of the agent for preventing epoxy-bleed-out is 5-80°C, preferably 10-50°C. If the temperature is too low, the epoxy-bleed-out effect is weak. If the temperature is too high, a higher effect cannot be expected and it is not preferable.

The method for preventing epoxy-bleed-out can be conducted by immersing wiring base material in a solution of an agent for preventing epoxy-bleed-out or spraying (shower, spray, etc.) the solution of an agent for preventing

epoxy-bleed-out on the base materials, and then washing with water, and drying.

A similar effect can be obtained by adding the above organic compounds, major components of the agent for preventing epoxy-bleed-out, to agents for preventing discoloration preventing or sealing treatment.

By the treatment for preventing epoxy-bleed-out mentioned above, the above organic compounds are adsorbed on the plated planes of surfaces of wiring base materials and a film comprising the organic compounds with a thickness of one to several molecules is formed. Therefore, a contact angle between a plated plane and epoxy resin is increased to enable suppression of bleeding of epoxy resins. Since a film of organic compounds adsorbed is very thin, no adverse influence is imparted to assembly properties such as a wire-bonding property and a molding property. Nor is effect of discoloration prevention or sealing treatment impaired.

Wiring base materials and semiconductor packages that had been subjected to treatment for preventing epoxy-bleed-out by the above method are encompassed in the present invention.

Examples

The present invention will be further illustrated based on the following examples, although it is not restricted by these examples.

(Examples 1-15)

Copper strike plating was conducted as undercoat on lead frame base materials made of copper alloy (Cu: 97.7%, Sn: 2.0%, Ni: 0.2% and P: 0.03%) to improve adhesiveness, and then silver spot plating was done on parts of pad parts and inner lead parts, or either one of copper plating, gold plating, or palladium plating was done on the whole surface of the lead frame.

After that, treatments for preventing epoxy-bleed-out shown in Tables 1-3 were conducted.

[Table 1]

Example						
	No.	1	2	3	4	5
	Plating film	Silver spot	Silver spot	Silver spot	Silver spot	Silver spot
Discoloration preventing treatment	Treatment	Present	Absent	Present	Present	Absent
	Composition of discoloration preventing liquid	Benzotriazole: 0.1 g/L	-	Benzotriazole: 0.1 g/L	Benzotriazole: 0.1 g/L	-
	pH	9.0	-	9.0	9.0	-
	Bath temperature (°C)	25	-	25	25	-
	Duration (s)	10	-	10	10	-
	Method	Immersion	-	Immersion	Immersion	-
Sealing treatment		Absent	Absent	Absent	Absent	Absent
Composition of epoxy-bleed-out preventing agent	Major component	Butyric acid: 1 g/L	Enanthic acid: 1 g/L	Capric acid: 1 g/L	Lauric acid: 1 g/L	Heptadecylic acid: 1g/L
	Solvent	-	Methanol: 100 mL/L	Methanol: 100 mL/L	Isopropyl alcohol: 100 mL/L	Isopropyl alcohol: 100 mL/L
	pH buffer	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L
	Surfactant	-	-	-	-	-
Conditions for prevention of epoxy-bleed-out	pH	10.0	10.0	10.0	10.0	10.0
	Liquid temperature (°C)	25	25	25	25	25
	Duration (s)	10	10	10	10	10
	Method	Immersion	Shower	Immersion	Immersion	Immersion
Evaluation	Epoxy-bleed-out	○	○	○	○	○
	Wire-bonding (g)	10.5	9.8	11.2	10.6	9.9
	Molding (kg/cm^2)	15.0	16.2	17.3	15.4	16.3
	Discoloration preventing effect	○	×	○	○	×
	Sealing treatment effect	×	×	×	×	×

Evaluation of epoxy-bleed-out

○: 0 μm, Δ: ≤100 μm, ×: ≥100 μm

Evaluation of discoloration preventing effect

○: no discoloration, ×: discoloration present

Evaluation of sealing treatment effect

○: no corrosion, ×: corrosion present

[Table 2]

		Example			
	No.	6	7	8	9
	Plating film	Silver spot	Silver spot	Silver spot	Silver
Discoloration preventing treatment	Treatment	Present	Present	Present	Presen
	Composition of discoloration preventing liquid	Benzotriazole: 0.1 g/L	Benzotriazole: 0.1 g/L	Benzotriazole: 0.1 g/L	Benzot zole: 0.1 g/L
	pH	9.0	9.0	9.0	9.0
	Bath temperature (°C)	25	25	25	25
	Duration (s)	10	10	10	10
	Method	Immersion	Immersion	Immersion	Immers
Sealing treatment	Treatment	Absent	Absent	Absent	Absent
Composition of epoxy-bleed-out preventing agent	Major component	Oleic acid: 1g/L	Thiobarbituric acid: 1 g/L	Mercptoacetic acid: 1 g/L	Hexade mercap 1g/L
	Solvent	Isopropyl alcohol: 100 mL/L	-	-	Methan 100 mL
	pH buffer	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L	Potassium pyrophosphate: 5g/L	Potassi pyroph phate: 5
	Surfactant	Polyoxyethylene nonylphenyl ether: 1 mg/L	-	-	Polyoxy ethylen nonylph ether: 1 mg/L
Conditions for prevention of epoxy-bleed-out	pH	10.0	10.0	10.0	10.0
	Liquid temperature (°C)	25	25	25	25
	Duration (s)	10	10	10	10
	Method	Shower	Immersion	Immersion	Shower
Evaluation	Epoxy-bleed-out	○	○	○	○
	Wire-bonding (g)	9.7	11.3	11.5	10.6
	Molding (kg/cm^2)	16.0	17.3	17.9	16.2
	Discoloration preventing effect	○	○	○	○
	Sealing treatment effect	×	×	×	○

Evaluation of epoxy-bleed-out

○: 0 μm, Δ: ≤100 μm ×: ≥100 μm

Evaluation of discoloration preventing effect

○: no discoloration, ×: discoloration present

Evaluation of sealing treatment effect

○: no corrosion, ×: corrosion present

[Table 3]

		Example				
	No.	11	12	13	14	15
	Plating film	Copper	Gold	Gold	Palladium	Palladium
Discoloration preventing treatment	Treatment	Present	Absent	Absent	Absent	Absent
	Composition of discoloration preventing liquid	Benzotria-zole: 0.1 g/L	-	-	-	-
	pH	9.0	-	-	-	-
	Bath temperature (°C)	25	-	-	-	-
	Duration (s)	10	-	-	-	-
	Method	Immersion	-	-	-	-
Sealing treatment	Treatment	Absent	Present	Absent	Absent	Present
	Composition of Sealing treatment liquid	-	Triethanol-amine 1.0 g/L	-	-	Triethanol-amine 1.0 g/L
	pH	-	9.0	-	-	9.0
	Bath temperature (°C)	-	25	-	-	25
	Duration (s)	-	10	-	-	10
	Method	-	Immersion	-	-	Immersion
Composition of epoxy-bleed-out preventing agent	Major component	Stearic acid 1 g/L	Linoleic acid 1 g/L	Mercapto-acetic acid 1 g/L	Undecylic acid: 1g/L	Decanethiol: 1 g/L
	Solvent	Isopropyl alcohol: 100 mL/L	Acetone 100 mL/L	Isopropyl alcohol: 100 mL/L	Isopropyl alcohol: 100 mL/L	Methanol: 100 mL/L
	pH buffer	Potassium pyrophos-phate: 5g/L	Potassium pyrophos-phate: 5g/L	Potassium pyrophos-phate: 5g/L	Potassium pyrophos-phate: 5g/L	Potassium pyrophos-phate: 5g/L
	Surfactant	-	-	Polyoxy-ethylene nonylphenyl ether: 1 mg/L	-	-
Conditions for prevention of epoxy-bleed-out	pH	10.0	10.0	10.0	10.0	10.0
	Liquid temperature (°C)	25	25	25	25	25
	Duration (s)	10	10	10	10	10
	Method	Immersion	Shower	Immersion	Shower	Immersion
Evaluation	Epoxy-bleed-out	○	○	○	○	○
	Wire-bonding (g)	5.2	10.8	11.5	9.6	9.2
	Molding (kg/cm^2)	18.1	9.5	9.0	8.9	17.3
	Discoloration preventing effect	○	○	○	○	○
	Sealing treatment effect	×	○	×	×	○

Evaluation of epoxy-bleed-out

○: 0 μm, Δ: ≤100 μm, ×: ≥100 μm

Evaluation of discoloration preventing effect

○: no discoloration, ×: discoloration present

Evaluation of sealing treatment effect

○: no corrosion, ×: corrosion present

Prior to the treatment for preventing epoxy-bleed-out, a part of the samples were subjected to discoloration preventing treatment or sealing treatment.

The discoloration preventing treatment was conducted under the following conditions:

Discoloration preventing solution: Major component: benzotriazole 0.1 g/L

pH: 9.0

Bath temperature: 25°C

Duration: 10 sec.

Method: Immersion

The sealing treatment was conducted under the following conditions:

Sealing treatment solution: Major component: triethanolamine 1.0 g/L

pH: 9.0

Bath temperature: 25°C

Duration: 10 sec.

Method: Immersion

These base materials were subjected to die-bonding and wire-bonding and then evaluated for epoxy-bleed-out, wire-bonding property, and molding property.

Epoxy-bleed-out was evaluated according the following method:

After being applied to plated surfaces, commercially available epoxy resin for low-stress die-bonding was heated at 200°C for 60 minutes for curing. Then, parts on which the

epoxy had been applied were observed microscopically (x 30) and amounts of epoxy-bleed-out were determined.

Wire-bonding property was evaluated according to the following method:

After wire-bonding was conducted by thermocompression boding together with ultrasonic treatment (temperature: 200°C, load 50 g, and during: 10 ms), pull-strength was determined with a pull-tester.

Molding property was evaluated according to the following method:

After commercially available epoxy resin for molding was applied on plated surfaces and then heated at 175°C for 5 hours for curing, shear-strength was determined.

In addition, the samples that had been subjected to the discoloration preventing treatment or sealing treatment were evaluated for an effect of discoloration preventing treatment or an effect of sealing treatment.

The effect of discoloration preventing treatment was evaluated, according to the method below, on the parts that had been subjected to spot plating or copper strike plating for the products that had been subjected to silver spot plating and on the plated parts for the products the whole surface of which had been plated.

The surface of plating was macroscopically observed after immersing in boiling pure water for 10 minutes.

The effect of sealing treatment was evaluated, according to the method below, on the plated surfaces both for the

products that had been subjected to spot plating and those that had been subjected to plating on the whole surface.

The surface of plating was macroscopically observed after immersing in an artificial sweat liquid with the following compositions at 40°C for 24 hours.

Artificial sweat liquid composition

Sodium chloride: 9.9 g/L

Sodium sulfate: 0.8 g/L

Urea: 1.7 g/L

Lactic acid: 1.1 mL/L

Ammonia water: 0.27 mL/L

pH: 5

The results are also shown in Tables 1-3.

(Examples 16-20)

Silver plating, gold plating, copper plating, or palladium plating was conducted on lead frame base materials made of copper alloy (Cu: 97.7%, Sn-2.0%, Ni: 0.2%, and P: 0.03%).

These wiring base materials were subjected to discoloration preventing treatment or sealing treatment. Upon the treatment, the agent for preventing epoxy-bleed-out according to the present invention was added to the discoloration preventing solution and sealing treatment solution as shown in Table 4.

[Table 4]

		Example				
	No.	16	17	18	19	20
	Plating film	Copper	Silver spot	Gold	Palladium	Copper
Discoloration preventing treatment	Treatment	Present	Present	Absent	Absent	Present
	Composition of discoloration preventing liquid	Benzotriazole: 0.1 g/L Linoleic acid: 1 g/L Isopropyl alcohol: 100 mL/L	Benzotriazole: 0.1 g/L Hexadecyl mercaptane: 1 g/L Isopropyl alcohol: 100 mL/L	-	-	Imidazole silane: 1.0 g/L Lauric acid: 1 g/L Isopropyl alcohol: 100 mL/L
	pH	9.0	9.0	-	-	9.0
	Bath temperature (°C)	25	25	-	-	25
	Duration (s)	10	10	-	-	10
	Method	Immersion	Immersion	-	-	Immersion
Sealing treatment	Treatment	Absent	Absent	Present	Present	Absent
	Composition of Sealing treatment liquid	-	-	Triethanol-amine: 1.0 g/L Butyric acid: 1 g/L	Triethanol-amine: 1.0 g/L Oleic acid: 1 g/L Isopropyl alcohol: 100 mL/L	-
	pH	-	-	9.0	9.0	-
	Bath temperature (°C)	-	-	25	25	-
	Duration (s)	-	-	10	10	-
	Method	-	-	Immersion	Immersion	-
Evaluation	Epoxy-bleed-out	○	○	○	○	○
	Wire-bonding (g)	5.3	10.1	10.3	8.9	5.7
	Molding (kg/cm^2)	16.5	15.3	10.1	16.5	15.3
	Discoloration preventing effect	○	○	○	○	○
	Sealing treatment effect	×	○	○	○	×

Evaluation of epoxy-bleed-out

○: 0 μm, Δ: ≤100 μm, ×: ≥100 μm

Evaluation of discoloration preventing effect

○: no discoloration, ×: discoloration present

Evaluation of sealing treatment effect

○: no corrosion, ×: corrosion present

These base materials were subjected to die-bonding and wire-bonding, and epoxy-bleed-out, wire-bonding property, molding property, and an effect of discoloration prevention or sealing treatment were evaluated as in Examples 1-15.

The results are also shown in Table 4.

(Comparative Examples 1-5)

Silver plating, gold plating, copper plating, or palladium plating was conducted on lead frame base materials made of copper alloy (Cu: 97.7%, Sn-2.0%, Ni: 0.2%, and P: 0.03%).

A part of the samples were subjected to discoloration preventing treatment or sealing treatment.

The discoloration preventing treatment was conducted under the following conditions:

Discoloration preventing solution: Major component: benzotriazole 0.1 g/L

pH: 9.0

Bath temperature: 25°C

Duration: 10 sec.

Method: Immersion

The sealing treatment was conducted under the following conditions:

Sealing treatment solution: Major component: triethanolamine 0.1 g/L

pH: 9.0

Bath temperature: 25°C

Duration: 10 sec.

Method: Immersion

These base materials were subjected to die-bonding and wire-bonding, and epoxy-bleed-out, wire-bonding property, molding property, and an effect of discoloration prevention or sealing treatment were evaluated.

The results are also shown in Table 5.

[Table 5]

Comparative Example						
	No.	1	2	3	4	5
	Plating film	Silver spot	Silver spot	Gold	Gold	Palladium
Discoloration preventing treatment	Treatment	Absent	Present	Absent	Absent	Absent
	Composition of discoloration preventing liquid	-	Benzotriazole: 0.1 g/L	-	-	-
	pH	-	9.0	-	-	-
	Bath temperature (°C)	-	25	-	-	-
	Duration (s)	-	10	-	-	-
	Method	-	Immersion	-	-	-
Sealing treatment	Treatment	Absent	Absent	Absent	Present	Absent
	Composition of Sealing treatment liquid	-	-	-	Triethanol-amine: 1.0 g/L	-
	pH	-	-	-	9.0	-
	Bath temperature (°C)	-	-	-	25	-
	Duration (s)	-	-	-	10	-
	Method	-	-	-	Immersion	-
Evaluation	Epoxy-bleed-out	Δ	×	Δ	×	×
	Wire-bonding (g)	11.2	10.8	10.3	11.8	9.6
	Molding (kg/cm^2)	15.3	16.2	9.5	8.7	16.5
	Discoloration preventing effect	×	○	○	○	○
	Sealing treatment effect	×	×	×	○	×

Evaluation of epoxy-bleed-out

○: 0 μm, Δ: ≤100 μm, ×: ≥100 μm

Evaluation of discoloration preventing effect

○: no discoloration, ×: discoloration present

Evaluation of sealing treatment effect

○: no corrosion, ×: corrosion present

(Results)

In the wiring base materials which had been subjected to the treatment for preventing epoxy-bleed-out using the agent for preventing epoxy-bleed-out according to the present invention (Examples 1-15), no occurrence of epoxy-bleed-out was observed in the die-bonding step. Also when the agent for preventing epoxy-bleed-out according to the present invention was added to a discoloration preventing solution or a sealing treatment solution (Examples 16-20), no occurrence of epoxy-bleed-out was observed in the die-bonding step. In all examples, the wiring-bonding property and molding property were good. In the base materials that had been subjected to the discoloration preventing treatment or sealing treatment, the effect of discoloration prevention and that of sealing treatment were attained as expected.

On the other hand, when the treatment for preventing epoxy-bleed-out (Comparative Examples 1-5) was not conducted, occurrence of epoxy-bleed-out was observed in the die-bonding step.

Advantages of the Invention

The treatment for preventing epoxy-bleed-out in which the agent for preventing epoxy-bleed-out according to the present invention was employed to adsorb organic compounds with an effect of preventing epoxy-bleed-out on the surfaces of semiconductor devices such as lead frames and printed wiring boards enables to prevent epoxy-bleed-out in a die-bonding step without impairing the effect of

discoloration prevention or that of sealing treatment. No adverse influence was imparted on assembly properties such as wiring-bonding property and molding property.

THIS SHEET HAS BEEN REPLACED

CLAIMS

1. An agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process characterized in that it contains at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof.

2. A method for preventing epoxy-bleed-out characterized in that wiring base materials are immersed in the agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process containing at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof, or the agent for preventing epoxy-bleed-out is sprayed on the wiring base materials.

3. A wiring base material and a semiconductor package characterized in that they have been subjected to epoxy-bleed-out preventing treatment by immersing the wiring base material in the agent for preventing epoxy-bleed-out in a die-bonding step in a semiconductor manufacturing process

This Sheet Has Been Replaced

* C L M S *

THIS SHEET HAS BEEN REPLACED

containing at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof, or spraying the agent for preventing epoxy-bleed-out on the wiring base material.

4. A wiring base material and a semiconductor package characterized in that at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof is adsorbed on the surfaces.

5. A solution for preventing discoloration or for sealing treatment characterized in that it contains the agent for preventing epoxy-bleed-out comprising at least one organic compound selected from carboxylic acids or thiols having three or more carbon atoms in the straight chain, carboxylic acids or thiols having benzene rings, carboxylic acids containing mercapto groups or hydroxy groups, unsaturated polyalcohols, nitrogen-containing heterocyclic compounds containing sulfurs in the molecules, and derivatives thereof.

This Sheet Has Been Replaced