CLAIMS

1. A semiconductor device, wherein two or more semiconductor elements are stacked and mount on a lead frame, the lead frame is electrically joined to the semiconductor element with a wire, and the semiconductor element, the wire and an electric junction are encapsulated with a cured product of an epoxy resin composition for encapsulating semiconductor device,

wherein the epoxy resin composition for encapsulating semiconductor device contains

(A) an epoxy resin;

(B) a curing agent; and

(C) an inorganic filler, and

wherein the (C) inorganic filler contains particles having particle diameter of equal to or smaller than two-thirds of a thinnest filled thickness at a rate of equal to or higher than 99.9 % by mass.

2. The semiconductor device according to claim 1, wherein the semiconductor elements are stacked to provide an air gap, and the air gap is filled with the cured product of the epoxy resin composition for encapsulating semiconductor device to constitute a filled section having the thinnest filled thickness.

3. The semiconductor device according to claim 2, wherein the thinnest thickness of the air gap between the semiconductor element and the semiconductor element or the air gap between the

semiconductor element and the lead frame along the stack direction is equivalent to the thinnest filled thickness.

4. The semiconductor device according to any one of claims 1 to 3, wherein the wire is a copper wire.

5. The semiconductor device according to any one of claims 1 to 4, wherein the semiconductor elements are stacked to be mounted on the lead frame through a spacer, and

wherein the (C) inorganic filler contains particles having particle diameter of equal to or smaller than two-thirds of the thickness of the spacer at a rate of equal to or higher than 99.9 % by mass.

6. The semiconductor device according to any one of claims 1 to 5, wherein the (C) inorganic filler contains silica.

7. The semiconductor device according to any one of claims 1 to 6, wherein the lead frame is electrically joined to the semiconductor element by a reverse bonding of the wire.

8. The semiconductor device according to claim 4, wherein purity of copper in the copper wire is equal to or higher than 99.99 % by mass.

9. The semiconductor device according to claim 4 or claim 8, wherein the copper wire includes a coating layer on the surface,

the coating layer being composed of a metallic material containing palladium.

10. The semiconductor device according to claim 9, wherein the thickness of the coating layer is equal to or larger than 0.001 μm and equal to or smaller than 0.02 μm.

11. The semiconductor device according to claim 5, wherein the thickness of the spacer is equal to or larger than 0.01 mm and equal to or smaller than 0.2 mm.

CLAIMS

1. A semiconductor device comprising two or more semiconductor elements that are stacked and mounted on a lead frame, the lead frame is electrically joined to the two or more semiconductor elements with a wire, and the semiconductor elements, the wire and an electric junction are encapsulated with a cured product of an epoxy resin composition for encapsulating the semiconductor device,

wherein the epoxy resin composition for encapsulating the semiconductor device contains:

(A) an epoxy resin;

(B) a curing agent; and

(C) an inorganic filler;

wherein the inorganic filler contains particles having particle diameter of equal to or smaller than two-thirds of a thinnest filled thickness at a rate of equal to or higher than 99.9 % by mass; and

the content rate of the inorganic filler is equal to or higher than 60 % by mass and is equal to or lower than 92 % by mass over the epoxy resin composition for encapsulating the semiconductor device.

2. The semiconductor device according to claim 1, wherein the semiconductor elements are stacked to provide an air gap, and the air gap is filled with the cured product of the epoxy resin composition for encapsulating the semiconductor device to constitute a filled section having the thinnest filled thickness.

3. The semiconductor device according to claim 2, wherein the thinnest thickness of the air gap between the semiconductor element and the semiconductor element or the air gap between the semiconductor element and the lead frame along the stack direction is equivalent to the thinnest filled thickness.

4. The semiconductor device according to claim 1, wherein the wire is a copper wire.

5. The semiconductor device according to claim 1, wherein the semiconductor elements are stacked to be mounted on the lead frame through a spacer, and

wherein the inorganic filler contains particles having particle diameter of equal to or smaller than two-thirds of the thickness of the spacer at a rate of equal to or higher than 99.9 % by mass.

6. The semiconductor device according to claim 1, wherein the inorganic filler contains silica.

7. The semiconductor device according to claim 1, wherein the lead frame is electrically joined to the semiconductor element by a reverse bonding of the wire.

8. The semiconductor device according to claim 4, wherein purity of copper in the copper wire is equal to or higher than 99.99 % by mass.

9. The semiconductor device according to claim 4, wherein the copper wire includes a coating layer on the surface, the coating layer being composed of a metallic material containing palladium.

10. The semiconductor device according to claim 9, wherein the thickness of the coating layer is equal to or larger than 0.001 μm and equal to or smaller than 0.02 μm.

11. The semiconductor device according to claim 5, wherein the thickness of the spacer is equal to or larger than 0.01 mm and equal to or smaller than 0.2 mm.

12. The semiconductor device according to claim 1, wherein

the semiconductor elements include a first semiconductor element and a second semiconductor element stacked through only a spacer,

wherein the spacer has a smaller plane area than the first semiconductor element and the second semiconductor element; and

wherein a filled section having the thinnest filled thickness is between the first semiconductor element and the second semiconductor element.

13. The semiconductor device according to claim 1, wherein the epoxy resin composition for encapsulating the semiconductor device contains a phenolic resin based curing agent as the curing agent.