Claims

1. A semiconductor device bonding wire comprising:

a core material whose components include copper as a main component;

an outer layer provided on said core material, said outer layer containing a metal M that differs from said core material in one or both of components and composition, and copper,

wherein said outer layer is 0.021 to 0.12μm in thickness,

a carbon concentration in an outermost surface of said outer layer is in a range of from 15 to 80mol%, and a region where the carbon concentration is in a range of from 5 to 80 mol% is 0.0004 to 0.01μm in thickness in a depth direction from a surface of said outer layer, when compared in terms of concentration relative to a total of metallic elements, carbon, oxygen and nitrogen.

2. The semiconductor device bonding wire according to claim 1, wherein said metal M constituting said outer layer includes at least one element selected from among Au, Pd, Pt and Rh as a main component.

3. The semiconductor device bonding wire according to claim 1 or 2, wherein said core material including copper as a main component contains at least one element selected from among P, B, Ir, Zr, Bi, Ti, Au, Ag, Sn and rare-earth elements, and an elemental concentration of said at least one element relative to the whole of the wire is in a range of from 0.0001 to 0.03mol% in total.

4. The semiconductor device bonding wire according to any one of claims 1 to 3, wherein said outer layer contains at least one element selected from among Bi, P, Se and Tl, and an elemental concentration of said at least one element on the outermost surface of said outer layer is in a range of from 0.01 to 5mol% in total.

5. The semiconductor device bonding wire according to any one of claims 1 to 4, wherein a diffusion layer is provided between said outer layer and said core material.

6. The semiconductor device bonding wire according to any one of claims 1 to 5, wherein an oxygen concentration in an outermost surface of said outer layer is in a range of from 1 to 25mol%, and a region where the oxygen concentration is in a range of from 0.2 to 25 mol% is 0.0005 to 0.007μm in thickness

inside said outer layer, when compared in terms of concentration relative to a total of metallic elements, carbon, oxygen and nitrogen.

7. The semiconductor device bonding wire according to any one of claims 1 to 6, wherein a region where a concentration of said metal M relative to a total of metallic elements is 10mol% or more is 0.03 to 0.2μm in thickness.

8. The semiconductor device bonding wire according to any one of claims 1 to 7, wherein a region inside said outer layer where a total concentration of said metal M relative to a total of metallic elements is 90mol% or more is 0.004 to 0.07μm in thickness.

9. The semiconductor device bonding wire according to any one of claims 1 to 8, wherein a region inside said outer layer where a total concentration of said metal M relative to a total of metallic elements is 96mol% or more is 0.002 to 0.06μm in thickness.

10. The semiconductor device bonding wire according to any one of claims 1 to 9, wherein a copper concentration relative to a total of metallic elements in the outermost layer of the outer layer is 0.5 to 45mol%.

11. The semiconductor device bonding wire according to any one of claims 1 to 10, wherein a region inside said outer layer where a copper concentration relative to a total of metallic elements is in a range of from 1 to 30mol% is 0.0005 to 0.008μm in thickness.

12. The semiconductor device bonding wire according to any one of claims 1 to 11, wherein a concentration of said metal M, which is contained in an entire wire and is other than copper, relative to a total of metallic elements is in a range of from 0.05 to 3mol%.

Claims

1. A semiconductor device bonding wire comprising:

a core material whose components include copper as a main component;

an outer layer provided on said core material, said outer layer containing a metal M and copper, being a region having 0.021 to 0.12μm thickness where a concentration of said metal M is 50mol% or more, wherein

said metal M constituting said outer layer includes at least one element selected between Au and Pd as a main component.

2. The semiconductor device bonding wire according to claim 1, wherein said outer layer contains at least one element selected from among Bi, P, Se and Tl, and an elemental concentration of said at least one element on an outermost surface of said outer layer is in a range of from 0.01 to 5mol% in total.

3. The semiconductor device bonding wire according to claim 1 or 2, wherein a diffusion layer is provided between said outer layer and said core material.

4. The semiconductor device bonding wire according to any one of claims 1 to 3, wherein a region where a concentration of said metal M relative to a total of the metallic elements is 10mol% or more is 0.03 to 0.2μm in thickness.

5. The semiconductor device bonding wire according to any one of claims 1 to 4, wherein a region inside said outer layer where a total concentration of said metal M

relative to a total of the metallic elements is 90mol% or more is 0.004 to 0.07μm in thickness.

6. The semiconductor device bonding wire according to any one of claims 1 to 5, wherein a region inside said outer layer where a total concentration of said metal M relative to a total of the metallic elements is 96mol% or more is 0.002 to 0.06μm in thickness.

7. The semiconductor device bonding wire according to any one of claims 1 to 6, wherein a copper concentration relative to a total of the metallic elements in the outermost layer of the outer layer is 0.5 to 45mol%.

8. The semiconductor device bonding wire according to any one of claims 1 to 7, wherein a region in the surface of said outer layer where a copper concentration relative to a total of the metallic elements is in a range of from 1 to 30mol% is 0.0005 to 0.008μm in thickness.

9. The semiconductor device bonding wire according to any one of claims 1 to 8, wherein a concentration of said metal M, which is contained in an entire wire and is other than copper, relative to a total of the metallic elements is in a range of from 0.05 to 3mol%.