CLAIMS

1. A joined body, comprising:

a first member;

a second member; and

a sintered metal layer that joins the first member and the second member,

wherein the sintered metal layer includes a plurality of flake-shaped structures derived from flake-shaped copper particles, major axes of the plurality of flake-shaped structures being oriented in approximately parallel to an interface between the first member or the second member, and the sintered metal layer,

the amount of copper contained in the sintered metal layer is 65% by volume or greater on the basis of a volume of the sintered metal layer, and

a degree of orientation order S of the plurality of flake-shaped structures, as expressed by the following formula, is 0.88 to 1.00:

$$S = 1/2 \times (3\langle\cos^2\theta\rangle - 1)$$

θ representing an angle made by the interface and the major axis of a flake-shaped structure of the plurality of flake shaped structures, and $\langle\cos^2\theta\rangle$ representing an average value of a plurality of values of $\cos^2\theta$ for the plurality of flake-shaped structures.

2. The joined body according to claim 1,

wherein at least one of the first member and the second member includes at least one kind of metal selected from the group consisting of copper, nickel, silver, gold, and palladium on a surface that is in contact with the sintered metal layer.

3. A semiconductor device, comprising:

a first member;

a second member; and

a sintered metal layer that joins the first member and the second member,

wherein at least one of the first member and the second member is a semiconductor element,

the sintered metal layer includes a plurality of flake-shaped structures derived from flake-shaped copper particles, major axes of the plurality of flake-shaped structures being oriented in approximately parallel to an interface between the first member or the second member, and the sintered metal layer,

the amount of copper contained in the sintered metal layer is 65% by volume or greater on the basis of a volume of the sintered metal layer, and

a degree of orientation order S of the plurality of flake-shaped structures, as expressed by the following formula, is 0.88 to 1.00:

$S = 1/2 \times (3\langle\cos^2\theta\rangle - 1)$

θ representing an angle made by the interface and the major axis of a flake-shaped structure of the plurality of flake shaped structures, and $<\cos^2\theta>$ representing an average value of a plurality of values of $\cos^2\theta$ for the plurality of flake-shaped structures.

4. The semiconductor device according to claim 3, wherein die shear strength when the semiconductor element is pressed in a horizontal direction is 30 MPa or greater.

5. A semiconductor device, comprising:

a first electrode;

a semiconductor element that is electrically connected to the first electrode;

a second electrode that is electrically connected to the semiconductor element through a metal interconnection; and

a sintered metal layer including copper provided between the semiconductor element and the metal interconnection, and between the metal interconnection and the second electrode,

wherein the sintered metal layer is in contact with the metal interconnection and includes a plurality of flake-shaped structures derived from flake-shaped copper particles, major axes of the plurality of flake-shaped structures being oriented in approximately parallel to an interface with the metal interconnection, and

a degree of orientation order S of the plurality of flake-shaped structures, as expressed by the following formula, is 0.88 to 1.00:

$$S = 1/2 \times (3\langle\cos^2\theta\rangle - 1)$$

θ representing an angle made by the interface and the major axis of a flake-shaped structure of the plurality of flake shaped structures, and $\langle\cos^2\theta\rangle$ representing an average value of a plurality of values of $\cos^2\theta$ for the plurality of flake-shaped structures.

6. The semiconductor device according to claim 5, wherein the amount of copper contained in the sintered metal layer is 65% by volume or greater on the basis of a volume of the sintered metal layer.

7. A semiconductor device, comprising:

a first thermal conduction member;

a second thermal conduction member;

a semiconductor element that is disposed between the first thermal conduction member and the second thermal conduction member; and

at least one sintered metal layer including copper provided at one or more locations selected from

between the first thermal conduction member and the semiconductor element, and between the semiconductor element and the second thermal conduction member,

wherein a sintered metal layer of at least one sintered metal layer is in contact with the first thermal conduction member or the second thermal conduction member and includes a plurality of flake-shaped structures derived from flake-shaped copper particles, major axes of the plurality of flake-shaped structures being oriented in approximately parallel to an interface with the first thermal conduction member or the second thermal conduction member, and

a degree of orientation order S of the plurality of flake-shaped structures, as expressed by the following formula, is 0.88 to 1.00:

$$S = 1/2 \times (3\langle\cos^2\theta\rangle - 1)$$

θ representing an angle made by the interface and the major axis of a flake-shaped structure of the plurality of flake shaped structures, and $\langle\cos^2\theta\rangle$ representing an average value of a plurality of values of $\cos^2\theta$ for the plurality of flake-shaped structures.

8. The semiconductor device according to claim 7,

wherein the amount of copper contained in the sintered metal layer is 65% by volume or greater on the basis of a volume of the sintered metal layer.

9. The semiconductor device according to claim 5, comprising an insulating substrate having the first electrode and the second electrode provided on the substrate.