

CLAIMS

1. A copper alloy bonding wire for semiconductor devices,
consisting essentially of

in total 0.05% by mass or more to 3% by mass or less
5 of at least one or more kinds of first elements selected
from Ni, Zn, Ga, Ge, In, and Ir,

0.0001% by mass or more and 0.050% by mass or less of
each of at least one or more kinds of elements selected
from P, and Mg,

10 optionally in total 0.0005% by mass or more and 0.5%
by mass or less of at least one or more kinds of elements
selected from Ag and Au, with respect to the entire wire,
optionally 1.15% by mass or less of Pd,
with the balance being Cu and inevitable impurities,

15 and

wherein the copper alloy bonding wire is bare Cu alloy
wire.

2. A copper alloy bonding wire for semiconductor devices,
20 consisting essentially of

in total 0.07% by mass or more to 3% by mass or less
of more than one kinds of first elements selected from Ni,
Zn, Ga, Ge, Rh, In, Ir, and Pt,

optionally 0.0001% by mass or more and 0.050% by mass
25 or less of each of at least one or more kinds of elements
selected from Ti, B, P, Mg, Ca, La, As, Te, and Se, with
respect to the entire wire,

optionally in total 0.0005% by mass or more and 0.5%
by mass or less of at least one or more kinds of elements
30 selected from Ag and Au, with respect to the entire wire,
optionally 1.15% by mass or less of Pd,

with the balance being Cu and inevitable impurities,
and

wherein the copper alloy bonding wire is bare Cu alloy wire.

3. A copper alloy bonding wire for semiconductor devices,
5 comprising in total 0.05% by mass or more to 3% by mass or less of at least one or more kinds of first elements selected from Ni, Zn, Ga, Ge, In, and Ir, wherein the copper alloy bonding wire comprises 0.0001% by mass or more and 0.050% by mass or less of each of at least one or more
10 kinds of elements selected from P, and Mg, with the balance comprising Cu and inevitable impurities,

wherein the copper alloy bonding wire is bare Cu alloy wire, and

wherein an average crystal grain size (μm) in core
15 cross section in a direction vertical to a wire axis of the copper alloy bonding wire is

$$0.02 \times R + 0.4 \text{ or more} \quad (1a)$$

$$0.1 \times R + 0.5 \text{ or less} \quad (1b)$$

where R (μm) is a diameter of the wire.

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4. A copper alloy bonding wire for semiconductor devices,
comprising in total 0.07% by mass or more to 3% by mass or less of more than one kinds of first elements selected from Ni, Zn, Ga, Ge, Rh, In, Ir, and Pt, with the balance
25 comprising Cu and inevitable impurities,

wherein the copper alloy bonding wire is bare Cu alloy wire, and

wherein an average crystal grain size (μm) in core
cross section in a direction vertical to a wire axis of the
30 copper alloy bonding wire is

$$0.02 \times R + 0.4 \text{ or more} \quad (1a)$$

$$0.1 \times R + 0.5 \text{ or less} \quad (1b)$$

where R (μm) is a diameter of the wire.

5. The copper alloy bonding wire for semiconductor devices according to claim 4, wherein the copper alloy bonding wire further comprises 0.0001% by mass or more and 0.050% by mass or less of each of at least one or more kinds of elements selected from Ti, B, P, Mg, Ca, La, As, Te, and Se, with respect to the entire wire.

10 6. The copper alloy bonding wire for semiconductor devices according to any one of claims 3 to 5, wherein the copper alloy bonding wire further comprises in total 0.0005% by mass or more and 0.5% by mass or less of at least one or more kinds of elements selected from Ag and Au, 15 with respect to the entire wire.

7. The copper alloy bonding wire for semiconductor devices according to any one of claims 3 to 6, wherein the copper alloy bonding wire further comprises 1.15% by mass 20 or less of Pd.

8. The copper alloy bonding wire for semiconductor devices according to any one of claims 1 to 2, wherein an average crystal grain size (μm) in core cross section in a 25 direction vertical to a wire axis of the copper alloy bonding wire is

$$0.02 \times R + 0.4 \text{ or more} \quad (1a)$$

$$0.1 \times R + 0.5 \text{ or less} \quad (1b)$$

where R (μm) is a diameter of the wire.

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9. The copper alloy bonding wire for semiconductor devices according to any one of claims 1 to 8, wherein an

average film thickness of copper oxide on a surface of the wire is in a range of 0.0005 μm or more and 0.02 μm or less.

10. The copper alloy bonding wire for semiconductor
5 devices according to any one of claims 1, 8 and 9, wherein the copper alloy bonding wire consists essentially of two or more kinds of first elements selected from Ni, Zn, Ga, Ge, In, and Ir.

10 11. The copper alloy bonding wire for semiconductor devices according to any one of claims 3, 5, 6, 7 and 9, wherein the copper alloy bonding wire comprises two or more kinds of first elements selected from Ni, Zn, Ga, Ge, In, and Ir.