

JIS

JAPANESE INDUSTRIAL STANDARD

Electroless copper platings

JIS H 8646—1991

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Electroless copper platings

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1. Scope

This Japanese Industrial Standard specifies the electroless copper plating (hereafter referred to as the "plating") 5 μm or thicker used for printed wiring boards by additive process.

Remarks 1. The printed wiring board by additive process used in this standard refers to a printed wiring board of which electroless copper plating method is applied to form conductor on a part or whole of surface of a base substrate.

2. The applicable standards to this Standard are listed below:

JIS B 7502-Micrometer Callipers for External Measurement

JIS B 7507-Vernier Callipers

JIS B 7721-Tensile Testing Machines

JIS C 5012-Test Methods For Printed Wiring Boards

JIS C 6480-General Rules of Copper-Clad Laminates for Printed Wiring Boards

JIS H 0400-Glossary of Terms Used in Electroplating

JIS H 0404-Graphical Symbol for Electroplated Coating

JIS H 1051-Methods for Determination of Copper in Copper and Copper Alloys

JIS H 8501-Methods of Thickness Test for Metallic Coatings

JIS K 1308-Nitric Acid

JIS K 1321-Sulfuric Acid

JIS P 8115-Testing Method for Folding Endurance of Paper and Paperboard by MIT Tester

JIS R 6253-Waterproof Abrasive Papers

JIS Z 8902-Xenon Standard White Light Source

Informative Reference: The additive process includes fully-additive process, semi-additive process, partial additive process, panel-additive process and pattern-additive process.

- (1) Fully-additive Process A method of manufacture of circuits that through holes are based in an adhesive coated laminate, and wiring is formed only by electroless copper plating on the surfaces of flat portion and entire of holes.
- (2) Semi-additive Process A method of manufacture of circuits that through holes are bored in an adhesive coated laminate, electroless copper plating is applied, and wiring is formed by electrolytic deposition and etching on the surfaces of flat portion and entire of holes.
- (3) Partial-additive Process A method of manufacture of circuit that the wiring is formed on the flat surface by etching the copper foil of a copper-clad laminate, resist pattern for plating is provided thereon, and then only through-hole portions are coated by electroless copper plating.
- (4) Panel-additive Process A method of manufacture of circuit that holes are bored in a copper-clad laminate, whole surfaces including through-thickness holes are coated by electroless copper plating, copper of unnecessary portions is removed by etching, and wiring is formed on the surfaces of flat portion and holes.
- (5) Pattern-additive Process A method of manufacture of circuit that holes are bored in a copper-clad laminate, resist for coating is provided thereon, the wired portion on the flat surface and the through-thickness holes are coated by electroless copper plating, and copper of unnecessary portions on the flat surface is removed by etching.

2. Definitions of Terms

The definitions of principal terms used in this standard shall be as given in JIS H 0400.

3. Class and Symbol

3.1 Class The plating shall be classified into two categories as given in Table 1 according to their mechanical properties.

Table 1. Class and Mechanical Properties

Class	Substrate	Tensile strength	Elongation	Flexural fatigue characteristics	Remarks
Class 1	Copper-clad laminate, adhesive coated laminate, ceramic substrate, etc.	195 N/mm ² min.	3 % min.	400 times min.	For general use
Class 2	Copper-clad laminate, adhesive coated laminate, ceramic substrate, etc.	295 N/mm ² min.	7 % min.	800 times min.	For high reliability

3.2 Symbol The symbol for plating shall be in accordance with JIS H 0404. In the case of the substrate of copper-clad laminate, however, it shall be in accordance with the symbol of copper-clad laminate specified in JIS C 6480.

4. Quality

4.1 Appearance of Plating The appearance of the plating shall be examined in accordance with 6.1, and it shall be free from irregular colour, stain, wrinkle, pit, crack, flaw and rough deposit, and shall have four or less pinholes in a domain of 100 mm by 100 mm.

4.2 Minimum Thickness of Plating The minimum thickness of plating shall be measured in accordance with 6.2, and the results shall conform to the specified values or thicker.

4.3 Purity of Plating The purity of plating shall be determined in accordance with 6.3, and the results shall be 99.2 % or more.

4.4 Density of Plating The density of plating shall be determined in accordance with 6.4, and the results shall be 8.7 g/cm³ or more.

4.5 Volume Resistivity of Plating The volume resistance of plating shall be tested in accordance with 6.5, and the results shall be 2.5 $\mu\Omega \cdot \text{cm}$ or less at 20°C.

4.6 Mechanical Properties of Plating

4.6.1 Tensile Strength and Elongation of Plating The tensile strength and elongation of plating shall be tested in accordance with 6.6, and the results shall conform to Table 1.

4.6.2 Flexural Fatigue Characteristics of Plating The flexural fatigue characteristics of plating shall be tested in accordance with 6.7, and the results shall conform to Table 1.

5. Specimen

Each test specimen for determination of purity, density, volume resistance, tensile strength, elongation and flexural fatigue characteristics of plating shall be as specified in the following:

5.1 Preparation of Specimen A substrate of 300 mm by 300 mm is plated, and the plated layer is peeled therefrom. Thus the peeled layer shall be used as specimen.

5.2 Substrate A stainless steel sheet 0.2 mm to 1.0 mm in thickness finished with an abrasive paper of No. 1000 specified in JIS R 6253 shall be used as substrate.

5.3 Plating Procedure Rinse a matte finished stainless steel sheet with water, apply catalyst for electroless copper plating thereon, and immerse it into electroless plating solution. After completion of plating, rinse with water, and dry up within 10 min at 50°C or below.

Remarks: The load of bath in operation shall be 0.5 to 1.0 dm²/l, and, for adjustment, the material to be plated may additionally be immersed into the plating solution, as necessary.

5.4 Thickness of Plating The thickness of plating shall be measured in accordance with 6.2, and the results shall be in the range of 30 μm to 35 μm .

5.5 Heat Treatment of Plating Each test specimen used for determination of density, volume resistance, tensile strength, elongation and flexural fatigue characteristics specified in 5.1 shall be heat treated at a temperature of $160 \pm 5^\circ\text{C}$ and for a period of 75 ± 15 min in air.

6. Test

6.1 Appearance Test The appearance test shall be carried out as specified in Annex 1.

6.2 Thickness Test The thickness test shall be carried out in accordance with any of "microscopic method for cross-sectional thickness test", "coulometric method for thickness test", "X-ray fluorescence spectrometric method for thickness test", "beta back-scatter method for thickness test", "eddy current method for thickness test", or "gravimetric method for deposit quantity test" specified in JIS H 8501.

6.3 Purity Test The purity test shall be carried out as specified in Annex 2.

6.4 Density Test The mass of a test piece shall be measured in air at first and next in liquid of known of which density at the ordinary temperature is known, and then the density is obtained by the following formula:

$$\delta = \frac{W_a \times d}{W_a - W_1}$$

where, δ : density of test piece (g/cm^3)
 d : density of liquid (g/cm^3)
 W_a : mass of test piece in air (g)
 W_1 : mass of test piece in liquid (g)

6.5 Volume Resistivity Test The volume resistivity test shall be carried out as specified in Annex 3.

6.6 Tensile Test The tensile test shall be carried out as specified in Annex 4.

6.7 Flexural Fatigue Test The flexural fatigue test shall be carried out as specified in Annex 5.

7. Inspection

As for inspection of plating, the tests shall be carried out in accordance with 6., and the results which conform to the requirements of 4. shall be accepted.

Remarks 1. Choice of inspection items and test methods shall be the subject of agreement between the purchaser and supplier.

2. Number of specimen(s) and sequence of inspection shall be agreed between the purchaser and supplier.

8. Designation System of Plating

The designation system of plating shall consist of type of plating, substrate, the minimum thickness of plating and its class according to the requirements of 3. and in this sequence.

Example 1: Class 1 and $25 \mu\text{m}$ plating by electroless copper plating process on copper-clad laminate (glass fabric base, epoxy resin)

