

Metallic fine- patterns prepared by electroless plating

1. Introduction

Conductive metallic patterns can be fabricated by metallic foil etching, metallic paste printing, photolithographic etching, etc. (Figure 1). They all present a number of drawbacks, respectively. The line width is restricted to around 50 μ m in the metallic foil etching method. The metallic paste printing requires baking at high temperature to get the necessary conductivity, thereby restricting the substrate materials to alumina and other ceramics. The photolithographic etching gives a good line width in the order of submicrons, but requires deposition and sputtering in vacuum for fabricating metallic film which results in higher costs.

Our company has developed a photosensitive solution containing a catalyst for electroless plating, and is proposing a metallic patterning process using this solution. The proposed process is simple in nature, corrects the drawbacks mentioned above, and capable of producing fine metallic patterns with the line width of less than 5 μ m.

2. Fine Metallic Patterning Process

The fine metallic patterning process follows three steps as described below. The typical process conditions are shown in Figure 2.

1) Solution coating

* The photosensitive solution containing a catalyst for electroless plating is applied (by spin coating) over the substrate.

2) Photolithography

* The coat is UV exposed by way of a photo mas to harden the exposed portions.

* The non-exposed portions are removed with water-based developing solution.

* The exposed portions form catalytic pattern that retains the electroless plating catalyst.

3) Electroless plating

* The substrate is dipped in an electroless plating solution.

Plating progresses on the catalytic pattern to form the necessary metallic pattern.

Figure 3 shows an optical microscopic image of the copper pattern formed on a glass substrate by the proposed process. The pattern has a good selectivity with the line/space ratio of 5/5 μ m.

3. Unique Features of the Process

* Simple process conditions

Low temperature (no higher than 150 $^{\circ}$ C)

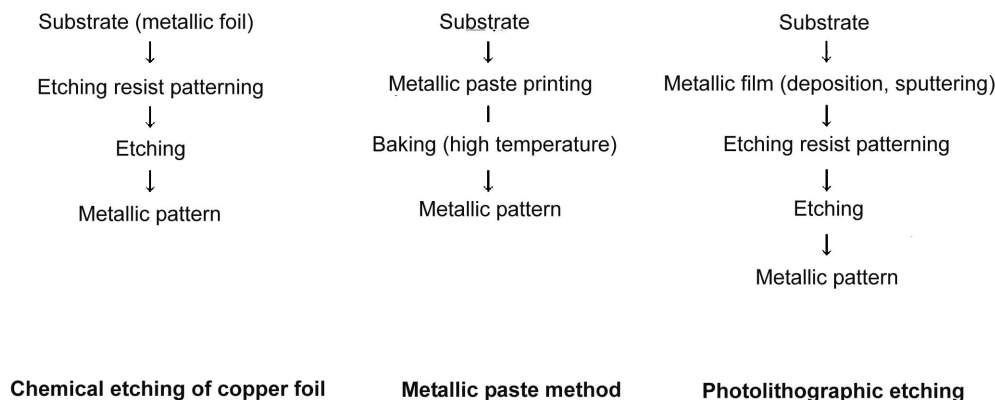


Fig. 1 Conventional metallic patterning processes

- No need for etching
- No need for vacuum
- Use of water-based developing agent
- * Metallic pattern line width (plating selectivity)
 - Line/space ratio 5/5 μ m (plating thickness 0.5 μ m)
- * Sensitivity to i-radiation UV exposure ($\lambda= 365$ nm)
 - 500mJ/cm²
- * Substrates
 - Insulating substrates (glass, resin, etc.) may be used as the substrate on which patterns are formed

4. Summary

Using the proposed conductive patterning method, fine metallic patterns can be produced in a simple process. Patterns can be formed on insulating substrates as well. The proposed process can be applied to circuit patterning and to other purposes.

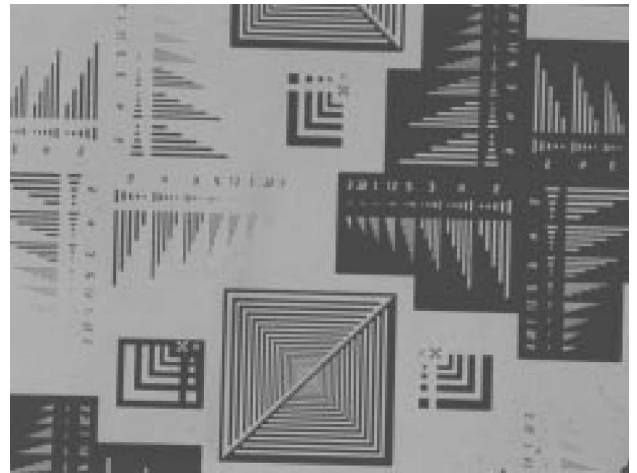


Photo 3 Optical microscopic image of fine copper pattern formed by the proposed method

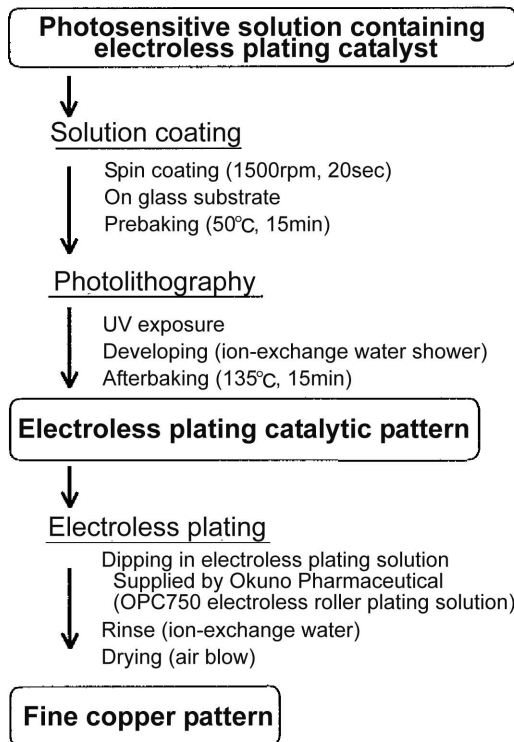


Fig. 2 Fine copper patterning process using fine metallic patterning material