

## Accepted Manuscript

Title: Selective copper metallization of nonconductive materials using jet-circulating electrodeposition

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PII: S0141-6359(17)30146-0  
DOI: <http://dx.doi.org/doi:10.1016/j.precisioneng.2017.08.005>  
Reference: PRE 6634

To appear in: *Precision Engineering*

Received date: 9-3-2017  
Revised date: 24-7-2017  
Accepted date: 9-8-2017

Please cite this article as: Kim Haan, Kim Jang Gil, Park Jong Wuk, Chu Chong Nam. Selective copper metallization of nonconductive materials using jet-circulating electrodeposition. *Precision Engineering* <http://dx.doi.org/10.1016/j.precisioneng.2017.08.005>

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# Selective copper metallization of nonconductive materials using jet-circulating electrodeposition

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Highlights Copper pattern metallization using jet-circulating electrodeposition is proposed.

- Selective metal patterning can be achieved via jet-circulating electrodeposition process.
- Pulse-reverse electrodeposition technique should be applied for high deposition rate.
- Electrolyte jetting condition should be controlled during deposition process.

## Abstract

In this paper, a novel selective copper metallization technique that can be used on various materials, such as glass, plastic and ceramic, is proposed. The process consists of three steps: seed layer development, pattern fabrication using jet-circulating electrodeposition, and seed layer removal. A copper seed layer for electrodeposition was formed on various materials by electron beam evaporation. Jet-circulating electrodeposition was implemented to fabricate micro-metal patterns. Localizing the circulation of a jetted electrolyte through two concentric nozzles enables rapid selective electrodeposition. The geometry of the copper pattern was investigated by means of scanning electron microscopy (SEM) and a surface profiler. As a result, copper pattern in various shapes was fabricated. The usage of an outer diameter of 290  $\mu\text{m}$  electrode nozzle, results in a copper pattern with a width of 430  $\mu\text{m}$  and a height of 28  $\mu\text{m}$ . Parameter study of the jet-circulating electrodeposition condition to investigate the electrodeposition mode, electrolyte jetting pressure, and

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