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Site-selective electroless plating of copper on a poly(ethylene terephthalate) surface modified with a self-assembled monolayer

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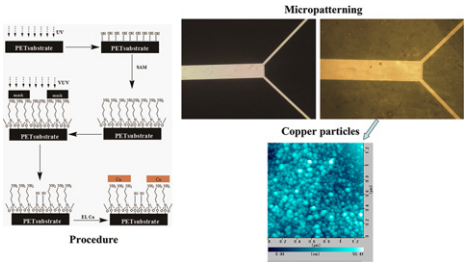
HIGHLIGHTS

- Site-selective copper micropatterning is obtained by electroless plating.
- The deposition is carried out on flexible substrates modified with SAMs.
- The whole process is successfully conducted at a relatively low temperature.
- The micropatterning possesses both good selectivity and high fidelity.

GRAPHICAL ABSTRACT



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ABSTRACT

A technique to obtain the site-selective electroless deposition of copper on poly(ethylene terephthalate) substrates was studied in our research. The substrates were first treated with ultraviolet light. Then, on the surfaces of the substrates, self-assembled monolayers were grafted. The self-assembled monolayers were further modified by vacuum ultraviolet irradiation through a photomask, thus forming regions with different functional groups. Copper finally deposited on the specifical regions. As confirmed by scanning electron microscopy (SEM), atomic force microscopy (AFM) and X-ray photoelectron spectroscopy (XPS), the copper micropatterning possessed excellent selectivity and high fidelity. The feature size of copper micropatterning was approximately 2 μm and the diameter of copper particles was in the range of 50–100 nm.

1. Introduction

The microfabrication of electronic components with high resolution on flexible substrates has attracted tremendous attention recently due to its wide applications, such as low cost sensors, ultralarge scale integration (ULSI) devices, and flexible printed circuit (FPC) boards because of their high electromigration, superior electrical conductivity [1,2].

In the electronics industry, ultrahigh-density copper wiring is fabricated by the damascene process, which is widely applied in the practical fabrication of damascene structure on rigid substrates. However, it has not been utilized for the fabrication of metal micropatterning on flexible substrates. Thus, an effective preparation method of metallic circuit patterns on polymer substrates becomes essential for the manufacturing of flexible electronics [3].

Poly(ethylene terephthalate) (PET) has excellent performances such as stable chemical properties, high mechanical strength,

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