Selective metallization of flexible substrates by inkjet printing with electroless copper plating

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Selective metallization of flexible substrates by inkjet printing with electroless copper plating

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A new efficient approach for selective metallization of flexible substrates such as poly(ethyleneterephtalate) (PET) sheets has been developed (Figure 1). The method is based on the covalent grafting of a chelating polymer film poly-4-vinylpyridine (P4VP) able to complex metallic palladium ions which then serve as catalyst for a copper electroless plating step. A solution of P4VP containing the palladium ions (II) catalyst is firstly inkjet printed to form a metallization primer. This primer is then photo-grafted onto the surface using a flashlamp. By a photo-oxidation process, light allows the formation of free radicals on the P4VP layer in contact with the substrate. Thus, covalent adhesion between the substrate and the P4VP is achieved. A selective copper layer is finally grown on the activated primer by a copper electroless plating process. The grafted primer layer enhances the copper adhesion. A resistivity - measured with four probes - as low as 2.1 μΩ.cm (sheet resistance equivalent to 84 mΩ/□ for 250 nm thickness) is obtained, which is only 20% higher than the one of bulk copper. This new low-temperature process only requires a plating bath and is thus compatible with low-cost thermally unstable flexible polymer substrates and R2R printing processes. The final metallic layer notably shows a very good adhesion on PET substrate and good stability in ambient atmosphere.

This approach is a very attractive way to achieve localized plastic substrate (such as PET, Kapton) metallization under ambient conditions.

Due to the versatility of the process in terms of flexible substrate type, different applications can be targeted such as RFID, Plastronic, interconnects for flexible electronic.

Keywords: copper electroless plating, inkjet printing, printed electronics, flexible substrate, antenna

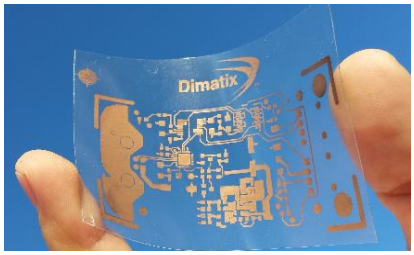

Figure 1: Copper patterns obtained on flexible substrate by electroless process after the primer printing, light-induced grafting and metallization steps.

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Oral presentation