Self-Reducible Copper Complexes for Printing on 2D and 3D Heat Sensitive Objects

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Direct printing of electrical contacts using silver particles inks has gained much interest recently. This approach opened the window for both fast prototyping, and Roll-to-Roll fabrication of various electronic devices, such as RFID tags, touch screens and flexible displays. However, the high cost of silver limits the fabrication of low-cost plastic devices, therefore there is a need to find a replacement. The most promising material is copper, having the second lowest resistivity of metals (only 5% less than silver), and its cost is about 90 times lower. Nevertheless, the main obstacle in utilizing inks containing copper nanoparticles is the rapid oxidation of the particles before and after printing.

Here we describe the formation and utilization of a copper complex ink that undergoes decomposition to yield copper nanoparticles. The ink is stable at ambient conditions, as compared to what is usually encountered in nanoparticles-based inks, such as aggregation and formation of copper oxide. The copper complex undergoes a self-reduction process to pure copper via a decomposition process. The formation of copper nanoparticles, analysis of decomposition process and film formation were evaluated using a variety of analytical tools. Finally, printed patterns were obtained on 2D and 3D substrates as can be seen in Figure 1.

Figures

Figure 1: Ink-Jet printed copper pattern on PET film (left), and on 3D printed plastic object (right)