

Fabrication of Metal Mesh Using NIL and Silver Paste for Transparent Conductive Films

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Indium tin oxide (ITO) has been the major material for transparent conductive films (TCFs) in many applications, such as photovoltaics and capacitive touch screen devices. As the market of smart devices with touch screens grows rapidly, there is increasing concern that indium might run dry around 2020. Many efforts have been made to find alternative materials for such TCFs applications. Graphene, silver nanowires and metal mesh have been considered as the promising replacements. Compared with other alternatives, metal mesh can achieve extremely low sheet resistance ($< 1 \Omega/\square$) and high transparency ($>90\%$), and metal mesh TCFs can be used for medium and large size displays. The fabrication process can be integrated to roll-to-roll production line, yielding very low cost and flexibility.^{1,2}

We show a fast and affordable scheme for fabrication of metal mesh TCFs where silver paste and nanoimprint lithography (NIL) are used. As shown in Figure 1, mesh pattern is fabricated through regular UV NIL process on glass substrate using transparent UV resist, since NIL is a high resolution and high throughput nanolithography technique. To ensure the high transparency of the metal mesh, the linewidth should be subwavelength. Secondly, silver paste is coated on top of such mesh pattern. In the third step, different approaches are used to remove excessive silver paste so that cured UV imprint resist are exposed. Finally, the silver paste is thermally cured and thus fabrication of TCFs can be achieved. Further applications of such TCFs would be discussed, particularly for touch screen devices (Figure 2).

¹ Kang M-G, Park HJ, Se Hyun A, Xu T, Guo LJ. Toward Low-Cost, High-Efficiency, and Scalable Organic Solar Cells with Transparent Metal Electrode and Improved Domain Morphology. Selected Topics in Quantum Electronics, IEEE Journal of. 2010;16(6):1807-20.

² Kang M-G, Kim M-S, Kim J, Guo LJ. Organic Solar Cells Using Nanoimprinted Transparent Metal Electrodes. Advanced Materials. 2008;20(23):4408-13.

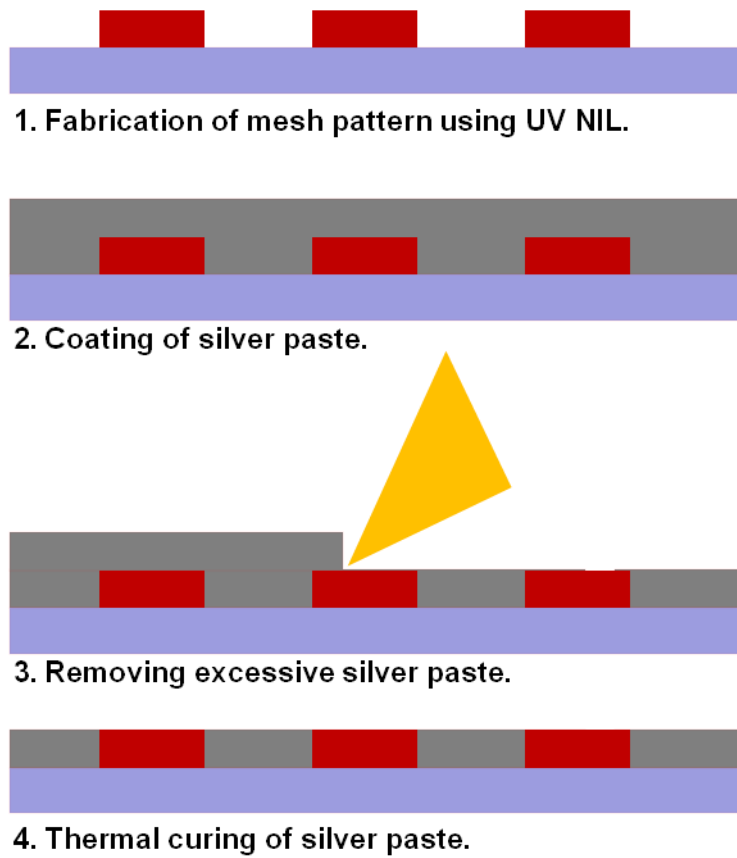


Figure 1. Fabrication process of metal mesh using NIL and silver paste.



Figure 2. A photograph of screen printed silver electrode on top of patterned metal mesh TCFs in a touch screen sensor.