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Inkjet Printed Silver Nanowire Network as Semi-Transparent Electrode for Organic Photovoltaic Devices

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Abstract : Transparent conductive electrodes (TCEs) or transparent electrodes (TEs) are a crucial part of many electronic and optoelectronic devices such as touch panels, liquid crystal displays (LCDs), organic light-emitting diodes (OLEDs), solar cells, and transparent heaters. The indium tin oxide (ITO) electrode is the most widely utilized transparent electrode due to its excellent optoelectrical properties. However, the drawbacks of ITO, such as the high cost of this material, scarcity of indium, and the fragile nature, limit the application in large-scale flexible electronic devices. Importantly, flexibility is becoming more and more attractive since flexible electrodes have the potential to open new applications which require transparent electrodes to be flexible, cheap, and compatible with large-scale manufacturing methods. So far, several materials as alternatives to ITO have been developed, including metal nanowires, conjugated polymers, carbon nanotubes, graphene, etc., which have been extensively investigated for use as flexible and low-cost electrodes. Among them, silver nanowires (AgNW) are one of the promising alternatives to ITO thanks to their excellent properties, high electrical conductivity as well as desirable light transmittance. In recent years, inkjet printing became a promising technique for large-scale printed flexible and stretchable electronics. However, inkjet printing of AgNWs still presents many challenges. In this study, a synthesis of stable AgNW that could compete with ITO was developed. This material was printed by inkjet technology directly on a flexible substrate. Additionally, we analyzed the surface microstructure, optical and electrical properties of the printed AgNW layers. Our further research focused on the study of all inkjet-printed organic modules with high efficiency.

Keywords : transparent electrodes, silver nanowires, inkjet printing, formulation of stable inks
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