

# Roll-to-Roll Sputtered ITO/Ag/ITO Multilayer Films for Flexible Organic Solar Cells and Flexible Heaters

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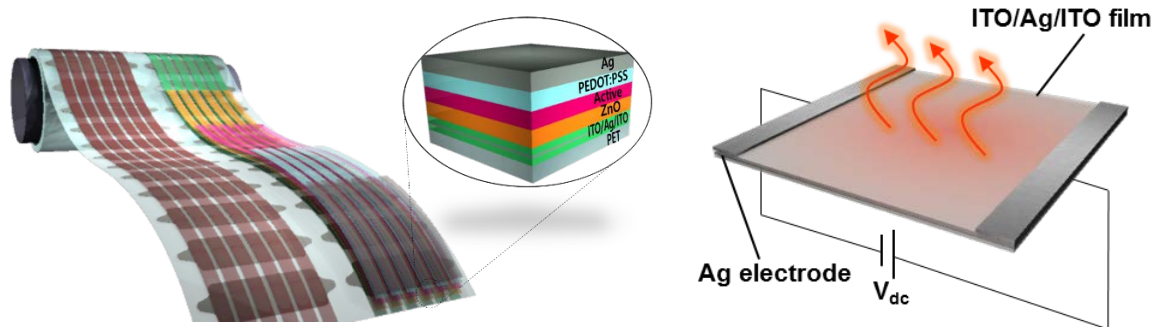
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## Summary

Indium tin oxide (ITO), Ag, and ITO layers were sputtered onto a flexible PET substrate with a 700 mm width by using a commercial roll-to-roll (RTR) sputtering system to use as a flexible and transparent anode for flexible organic solar cells (FOSCs) and flexible transparent heaters (FTHs) [1]. To optimize the electrical and optical properties of the ITO/Ag/ITO multilayer, the thickness of Ag layer were varied by controlling of the DC power applied on Ag targets during the RTR sputtering process. Compared to thickness control of the top and bottom ITO layer, the thickness control of the Ag layer is more effective to obtain a low sheet resistance and high transmittance ITO/Ag/ITO multilayer. At an optimized thickness of ITO (35 nm) and Ag (10 nm), a symmetric ITO/Ag/ITO multilayer showed a sheet resistance of 3.03  $\Omega$ /square and a high optical transmittance of 87.2 %. Various bending test results showed that the high failure strain of the Ag inter layer led to good flexibility of the multilayer films. Furthermore, we discuss the effect of the Ag layer thickness on the performance of FOSCs and FTHs fabricated on RTR sputtered ITO/Ag/ITO anodes.

**Keywords:** ITO/Ag/ITO, Roll-to-Roll sputtering, Flexible organic solar cells, Flexible transparent heaters



**Figure 1.** Flexible organic solar cells and flexible transparent heaters fabricated on roll-to-roll sputtered ITO/Ag/ITO multilayer electrodes.

[1] Han-Ki Kim et al., Large area Roll-to-Roll sputtering of transparent ITO/Ag/ITO cathode for flexible inverted organic solar cell modules, Solar Energy Materials and Solar Cells (Under review)