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Highly flexible and transparent $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ mesh electrodes grown by roll to roll sputtering for flexible touch screen panels

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We report on an indium-free and cost-effective $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ multilayer mesh electrode grown by room temperature roll-to-roll sputtering as a viable alternative to ITO electrodes for the cost-effective production of large-area flexible touch screen panels (TSPs). By using a low resistivity metallic Cu interlayer and a patterned mesh structure, we obtained $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ multilayer mesh electrodes with a low sheet resistance of 15.1 Ohm/square and high optical transmittance of 89 % as well as good mechanical flexibility. Outer/inner bending test results showed that the $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ mesh electrode had a mechanical flexibility superior to that of conventional ITO films. Using the diamond-patterned $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ multilayer mesh electrodes, we successfully demonstrated TSPs of the flexible film-film type and rigid glass-film-film type TSPs. The TSPs with $\text{Cu}_2\text{O}/\text{Cu}/\text{Cu}_2\text{O}$ mesh electrode were used to perform zoom in/out functions and multi-touch writing, indicating that these electrodes are promising cost-efficient transparent electrodes to substitute for conventional ITO electrodes in large-area flexible TSPs.

