**Highly Transparent and Conductive Nanomesh Films**

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**Abstract**

Metal nanomeshes with well controlled hole size and wire width, uniform hole distribution, templated by a monolayer of highly ordered micron/submicron colloidal particles are promising transparent conductive candidates for replacing traditional indium tin oxide (ITO) material which is restricted by the limited indium resource and the brittle nature. 1,2 However, they usually exhibit transmittance lower than 80% in the visible range and it is difficult to achieve higher transmittance by engineering the mesh size, which hinders its advantages. 3,4 In this work, we report new nanomesh transparent conductive films to overcome transmittance limitation of the metal nanomeshes. The as-prepared films show high transmittance over 90% and sheet resistance lower than 70 Ω sq−1 with small hole size less than 750 nm. They are highly flexible and can stand more than 1000 times bending at the radius of 3 mm. Moreover, it is compatible with the large area fabrication and patterning as demonstrated in the 130 cm \* 80 cm patterned transparent and flexible circuit application. Further, the water contact angles of the films can be adjusted by controlling the wire width and the hole size of the mesh structure. Finally, we show the application of a pair of hydrophobic nanomesh films as easy recycling flexible electrodes in electrochromic devices. The nanomesh transparent conductive films open new possibilities for the design and fabrication of novel patterned transparent electrodes for broad optoelectronics.

**References**

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