#### **Supporting Information**

#### Performance Enhancement of Metal Nanowire-based Transparent Electrodes by

#### **Electrically Driven Nanoscale Nucleation of Metal Oxides**

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## Electrical contact for ZnO nucleation treatment



Fig. S1 (a) Cu tape and (b) Ag paste electrical contact for ZnO nucleation treatment.

### Experimental set up flow diagram of nanoscale Ag atom migration



**Fig. S2** Experimental set up showing nanoscale Ag atom migration at a junction. The red dot represents where the migration might occur by joule heating.

R<sub>sh</sub> reduction with current injections on pristine AgNW networks



Fig. S3 Sheet resistance  $R_{sh}$  reduction under various current injections on pristine AgNW network. The  $R_{sh}$  is successfully reduced by about 1.5 orders of magnitude within 150 s. The inset shows that electrical breakdown of AgNWs is observed after extended current injection.

#### Experimental set up flow diagram of conventional sol-gel ZnO



**Fig. S4** Experimental set up showing conventional sol-gel ZnO deposition via 5 min annealing at 150 °C.

Temperature (°C)	Time (min)	Sheet resistance( $\Omega$ sq <sup>-1</sup> )
100	20	595
120	20	502
140	20	286
160	20	200
180	20	206
200	20	$> 1 \times 10^7$ (AgNW breakdown)

Reduction of  $R_{sh}$  by thermal annealing of pristine AgNW

 $R_{sh} \ initial \sim 1100 \ (\Omega \ sq^{\text{-}1})$ 

**Table S1** Reduction of  $R_{sh}$  under various annealing temperature.

# Zoomed-in SEM images of nanoscale ZnO nucleation AgNW



**Fig. S5** Zoomed-in field emission scanning electron microscope (FE-SEM) images of nanoscale ZnO nucleation AgNW.

Photograph of nanoscale ZnO nucleation on AgNWs and conventional sol-gel ZnO AgNWs on PEN



Fig. S6 Photograph of flexible TCE fabricated by conventional sol-gel ZnO treated AgNWs (left,  $R_{sh} = 27 \ \Omega/sq$ ) and electrically driven nanoscale ZnO nucleation treated AgNWs (right,  $R_{sh} = 22 \ \Omega/sq$ ) on PEN.

Diameter of 35 nm vs. 90 nm AgNW under ZnO nucleation treatment



Fig. S7 R<sub>sh</sub> reduction under 800 mA applied current on d = 35 and 90 nm ZnO nucleation treated AgNW TCE. The final resistance shows similar values of 18 and 13  $\Omega$  sq<sup>-1</sup> respectively.

# Large area AgNW TCE uniformity of R<sub>sh</sub> after ZnO nucleation treatment



Fig. S8 Large area AgNW TCE uniformity of R<sub>sh</sub> after ZnO nucleation treatment.