Supporting Information

Synergetic effects of ligand exchange and reduction process enhancing both electrical and optical properties of Ag nanocrystals for multifunctional transparent electrodes

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Discussion on the analysis of nano-mesh structured transparent Ag NC electrodes

The performance of transparent Ag NC thin film electrodes was analyzed by fixing the line distance at 300 μm and changing the line width to 5, 10, and 15 μm. When the line width was 5 μm, the average sheet resistance was 9.77 Ω/□, 8.42 Ω/□ at 10 μm, and 7.86 Ω/□ at 15 μm. As the line width was increased, the sheet resistance decreased. The transmittance was found to be 94.7%, 89.7%, and 85.6% at line widths of 5, 10, and 15 μm, respectively, and the transmittance decreased significantly with increasing line width. Then, an experiment was conducted by changing the pitch to 200, 300, and 400 μm with the line width fixed at 5 μm. The average sheet resistances of the transparent electrodes when the pitch was 200 and 300 μm were 8.47 Ω/□ and 9.77 Ω/□, respectively. However, when the pitch was increased to 400 μm, the sheet resistance greatly increased to 11.17 Ω/□. The transmittances of the electrodes with 300 and 400 μm pitch were 94.7%, and 95.46%, respectively, and it decreased to 91.6% at 200 μm.

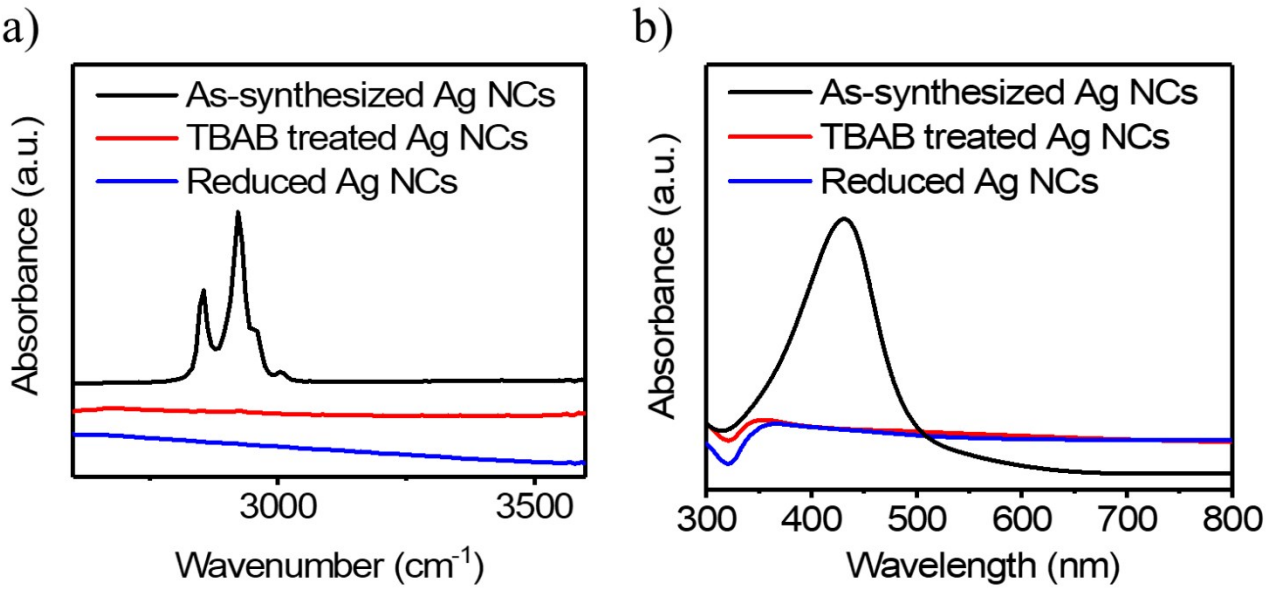

Fig. S1. (a) FTIR spectra and (b) UV-visible absorbance of as-synthesized (black), TBAB treated (red) and reduced Ag NC thin films (blue).

For the Ag NC thin film, a peak for CH- stretching was observed at 2900 cm^{-1}, indicating that Ag was surrounded by oleate ligands. In the Ag NC thin film treated with TBAB, the preceding CH- stretching peak disappeared, indicating that the oleate ligands were replaced with Br ligands. When a hydrazine treatment was additionally performed, no noticeable changes were observed.

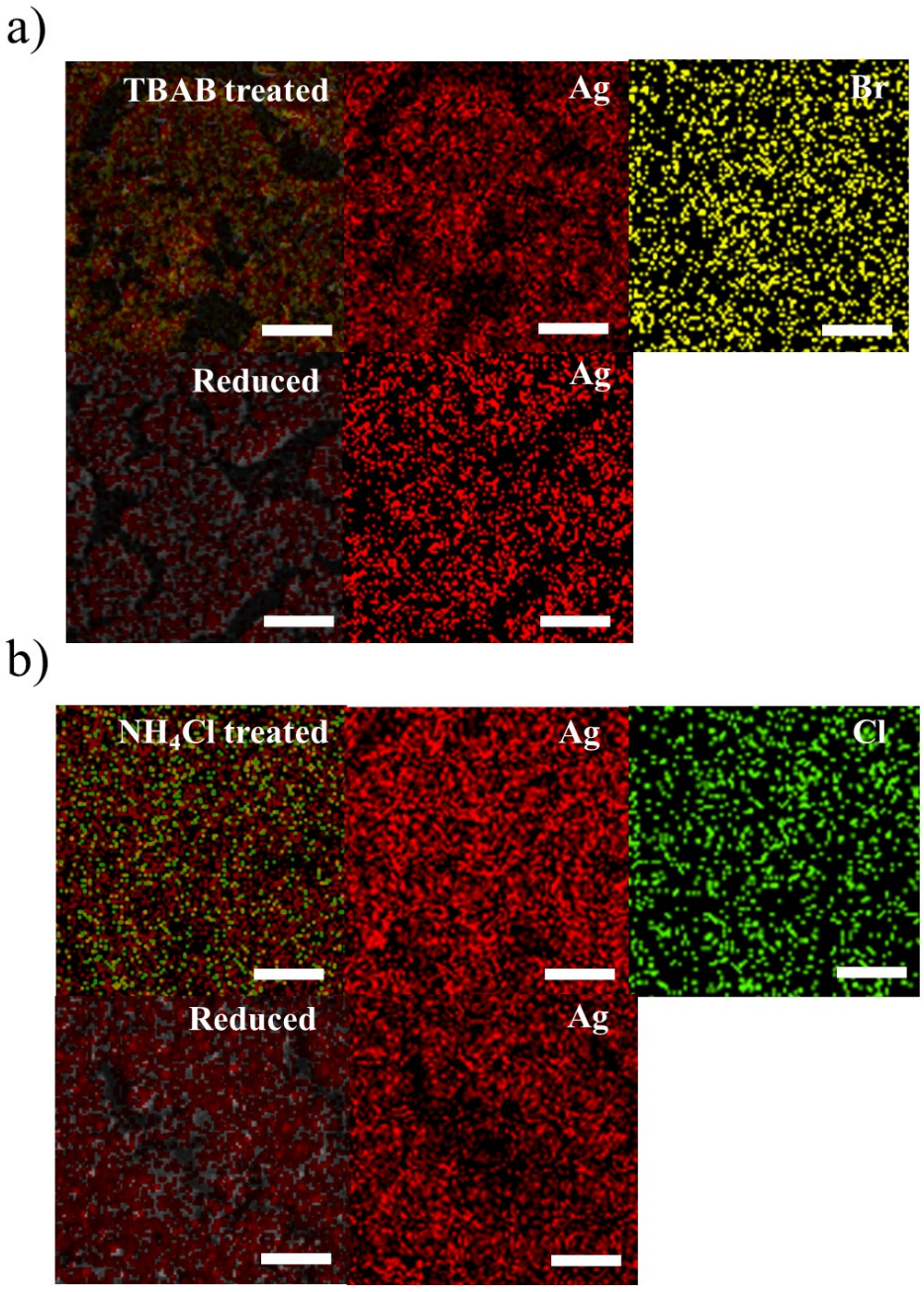

Fig. S2. SEM-EDX mapping images of TBAB treated and reduced Ag NC thin films. (b) SEM-EDX mapping images of NH4Cl treated and reduced Ag NC thin films. (scale bar: 1 μm)

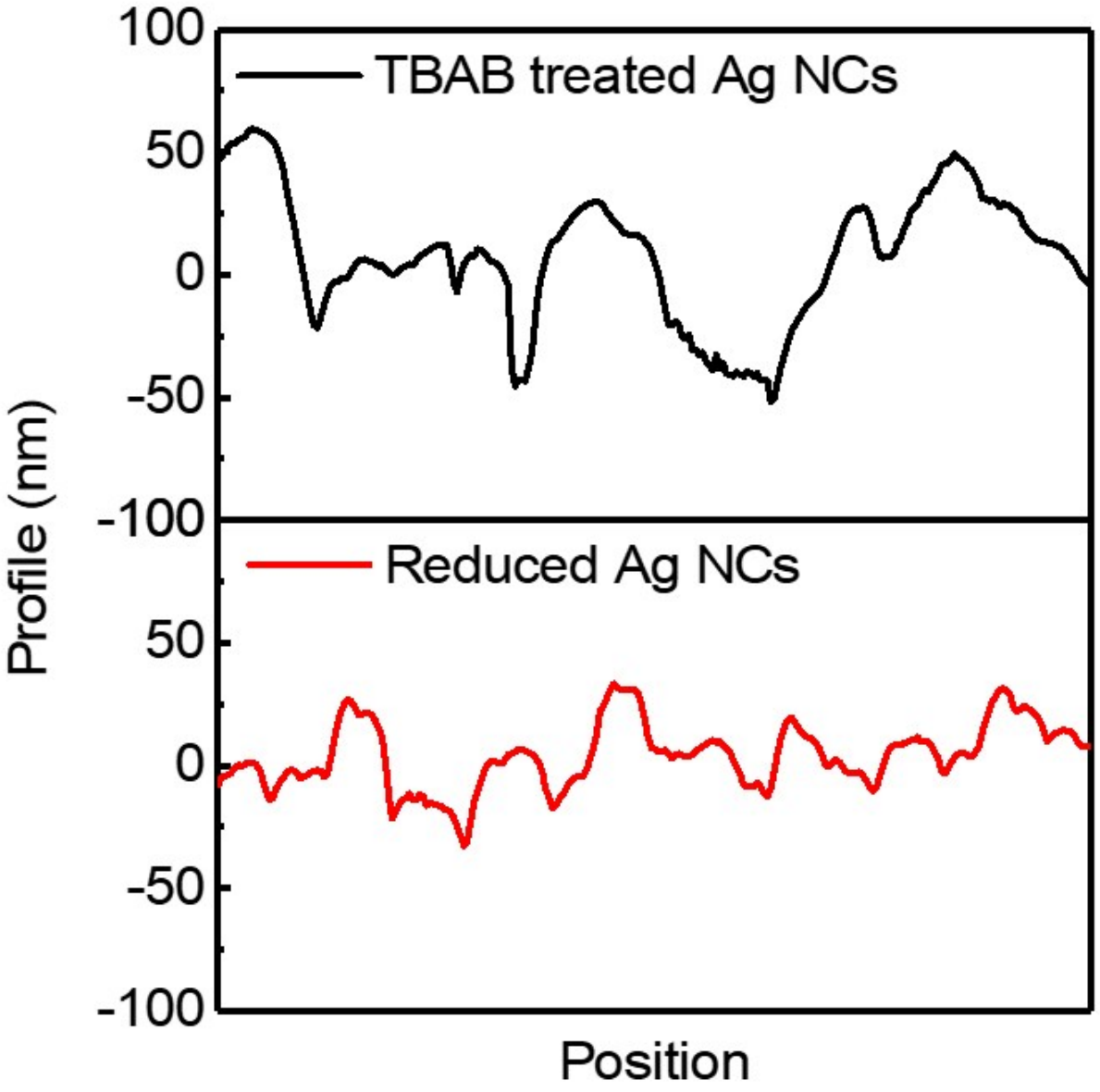

Fig. S3. Surface profile of TBAB treated (red) and reduced (blue) Ag NC thin films.

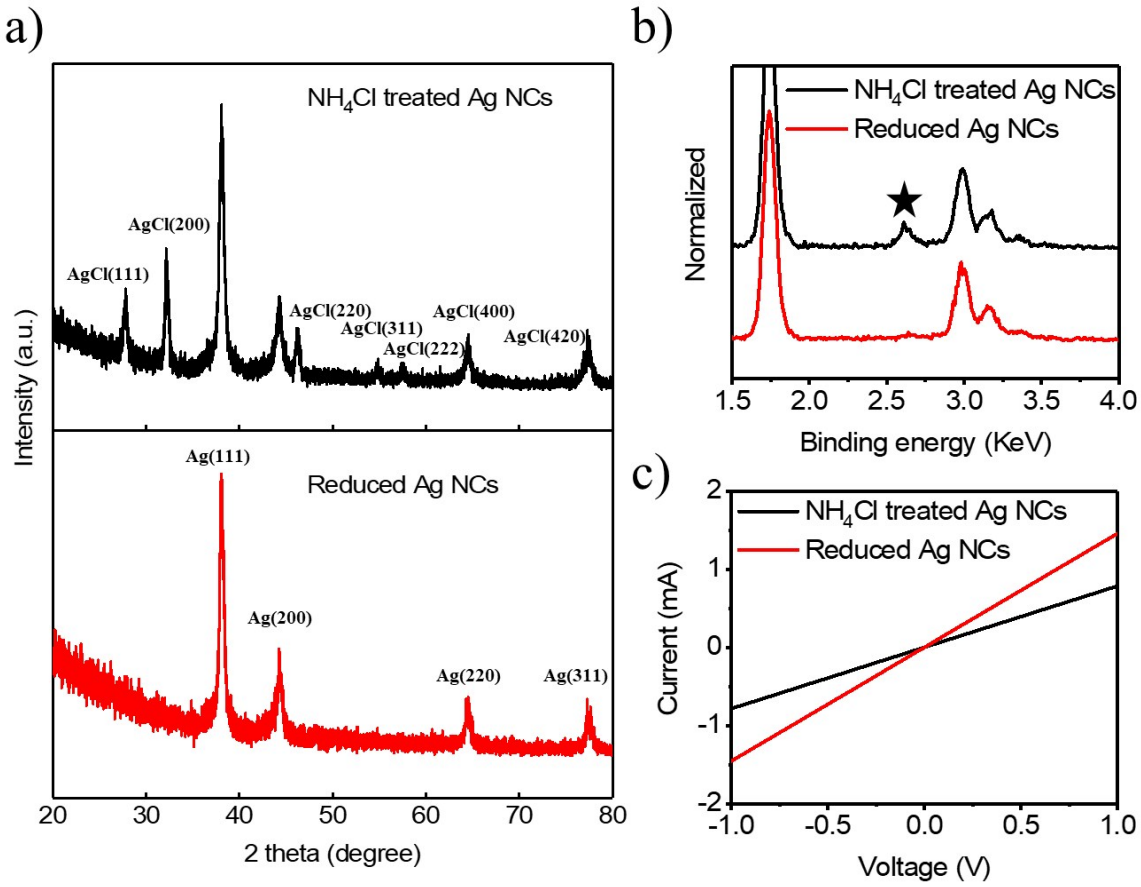

Fig. S4. (a) XRD spectra, (b) EDX analysis, and (c) I-V curve of NH_4Cl treated (red) and reduced Ag NC thin films (blue).

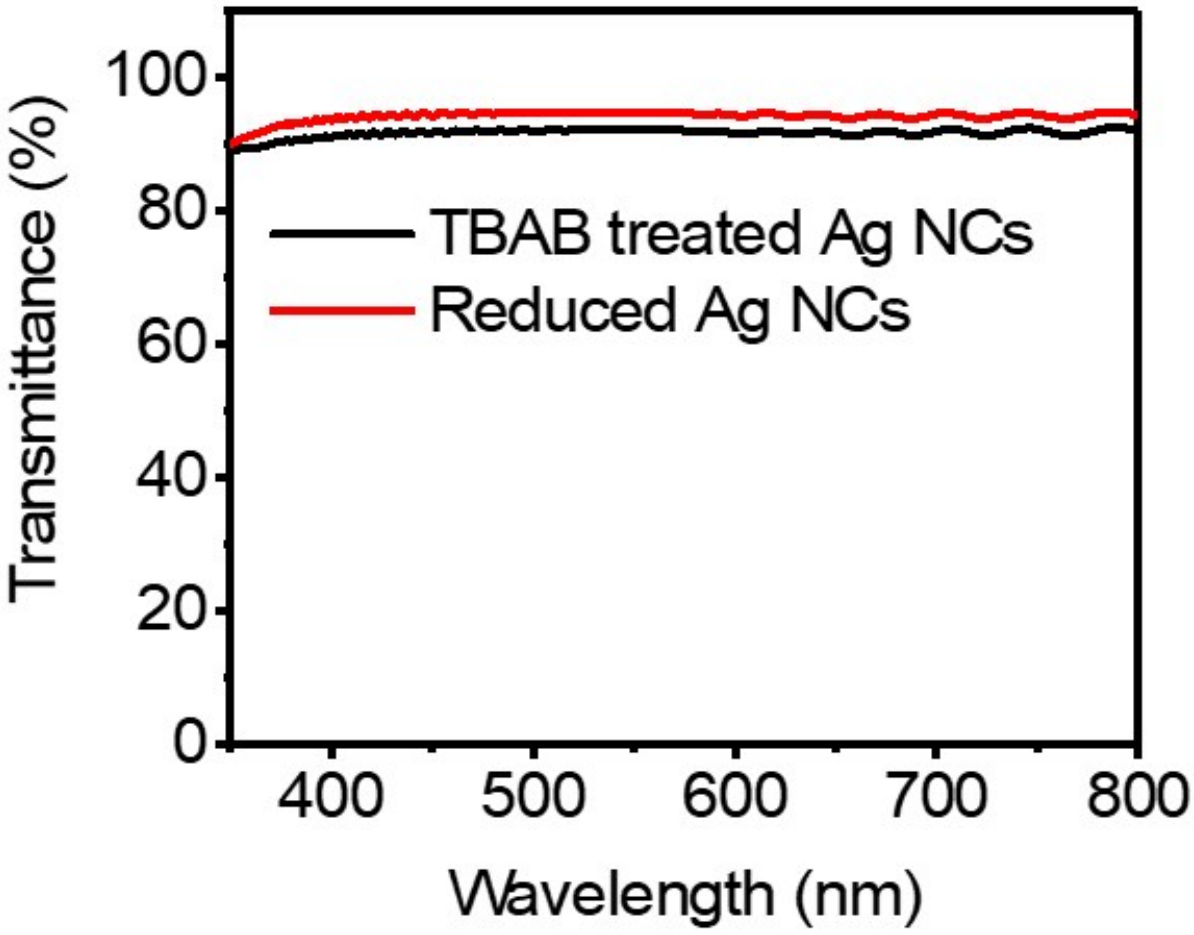

Fig. S5. UV-visible transmittance of TBAB treated (black) and reduced (red) nano-mesh structured transparent Ag NC electrode.

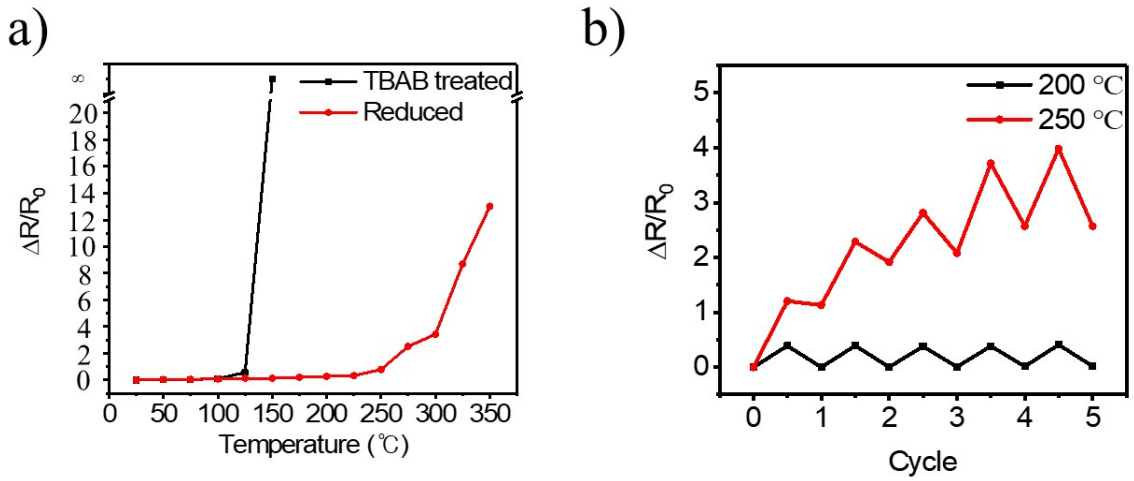

Fig. S6. (a) Relative resistance changes in only TBAB treated (black) and reduced (red) transparent electrode with increasing temperature up to 350 °C. (b) Relative resistance changes in the final transparent electrode when 25-200 °C (black) and 25-350 °C (red) temperature cycles are applied.

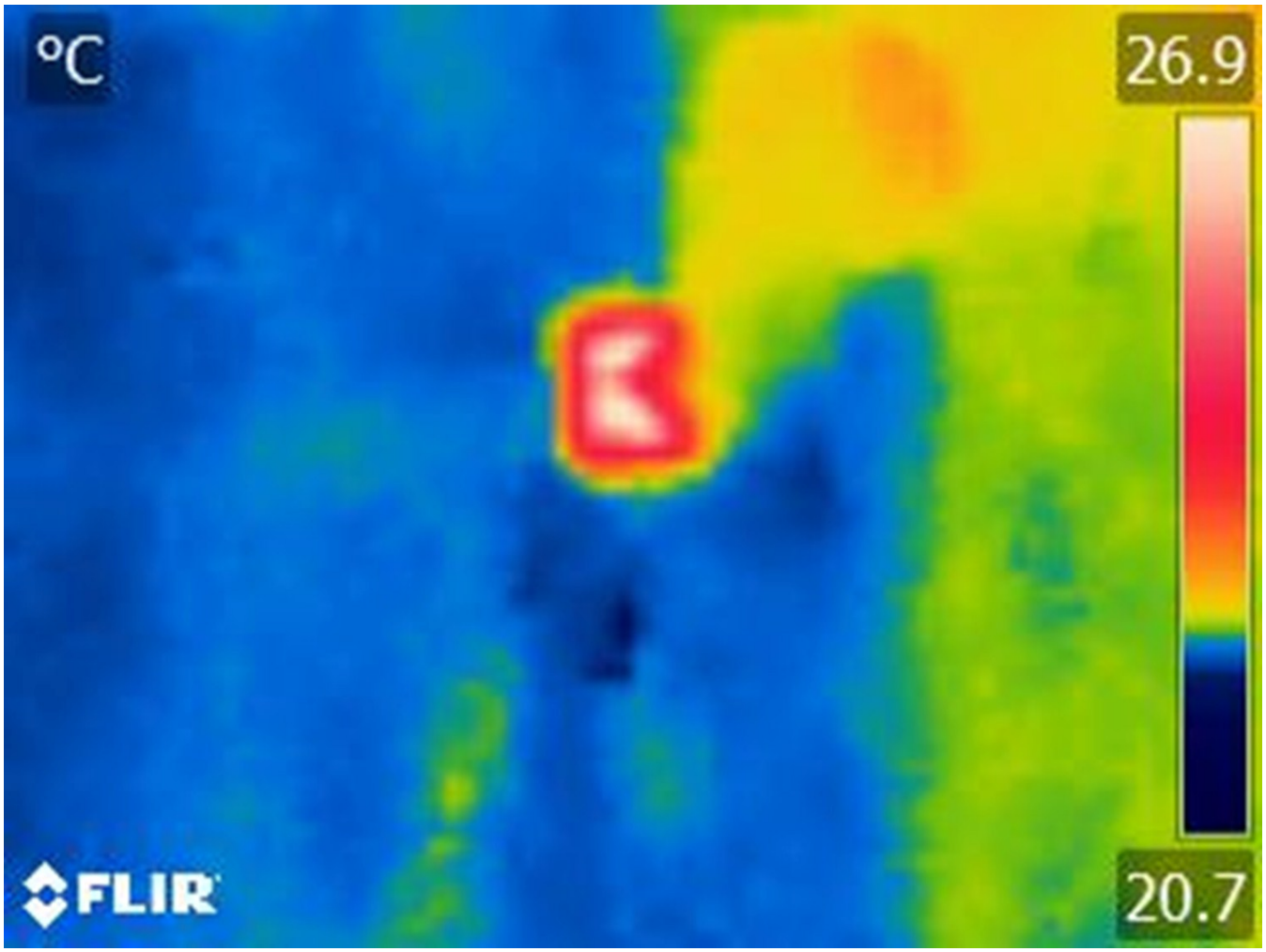

Fig. S7. IR image expressing the letter K with our nano-mesh structured transparent Ag NC electrode.