Supporting Information for

Femtosecond laser nanowelding of silver nanowires for transparent conductive electrodes

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1. Experimental results

◎ FE-SEM images of AgNWs after fs laser irradiation

**Figure S1 | FE-SEM images of AgNWs after the fs laser irradiation.** SEM images show AgNWs after fs laser irradiation varying laser fluence ($F$) at a fixed scan speed ($v$) = 0.1 mm/s.
Figure S2 | TEM images of AgNWs after the fs laser irradiation. TEM images shows AgNWs before fs laser irradiation. All scale bar is 10 nm.
Figure S3 | TEM images of AgNWs after the fs laser irradiation. TEM images shows AgNWs before fs laser irradiation at $F = 90 \text{ mJ/cm}^2$ and $v = 0.1 \text{ mm/s}$. The images was randomly obtained at three different position. All scale bar is 10 nm.
2. Numerical analysis

◎ Finite-difference time-domain method (FDTD) simulation

FDTD simulation was performed with a commercial package (Lumerical, FDTD Solutions). The optical properties of Ag were obtained from the tabulated data [E. D. Palik, Handbook of Optical Constants of Solids, Academic Press, 1998].

Figure S4 (a) Absorption efficiency of a free-standing AgNW under the illumination of light with transverse-magnetic polarization. Inset shows square of the electric field when LSP occurs; (b) Square of the electric field in the vicinity of junction between two perpendicular AgNWs at different wavelengths.
Two-temperature model simulation

Thermal analysis based on two temperature model was performed with a commercial package (COMSOL Multiphysics 5.0). We employed $C_e = A_e T_e$ and $k_e = k_0 T_e / T_l$ to model thermal properties of electrons, where $A_e$ is heat capacity coefficient. Physical properties of electron and lattice of silver was tabulated in Table S1. Cheng et al. experimentally measured the thermal conductivity of a single silver nanowire, which was reduced by 55% from the corresponding bulk’s value. We employed 193 W/mK as the thermal conductivity of the silver nanowire.\(^1\)

Table S1. Physical properties of electron and lattice of silver

| $A_e$ [J/m\(^3\)K\(^2\)] \(\text{Lin, 2008}\#41\) | 63.3 |
| $G$ [W/m\(^3\)K] \(\times 10^{17}\) | 0.2 |
| $C_l$ [J/m\(^3\)K] \(\times 10^{6}\) | 2.44 |
| $k_0$ [W/mK] \(\times 10^{6}\) | 193 |