Supporting Information for

Femtosecond laser nanowelding of silver nanowires for transparent conductive electrodes

Jeonghong Ha[†], Bong Jae Lee[‡], David Hwang[§], Dongsik Kim[†]

[†] Department of Mechanical Engineering, Pohang University of Science and Technology, Pohang 790-784, Republic of Korea

[‡] Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon 305-701, Republic of Korea

[§] Department of Mechanical Engineering, Stony Brook University, NY 11794, United States

1. Experimental results

◎ FE-SEM images of AgNWs after fs laser irradiation

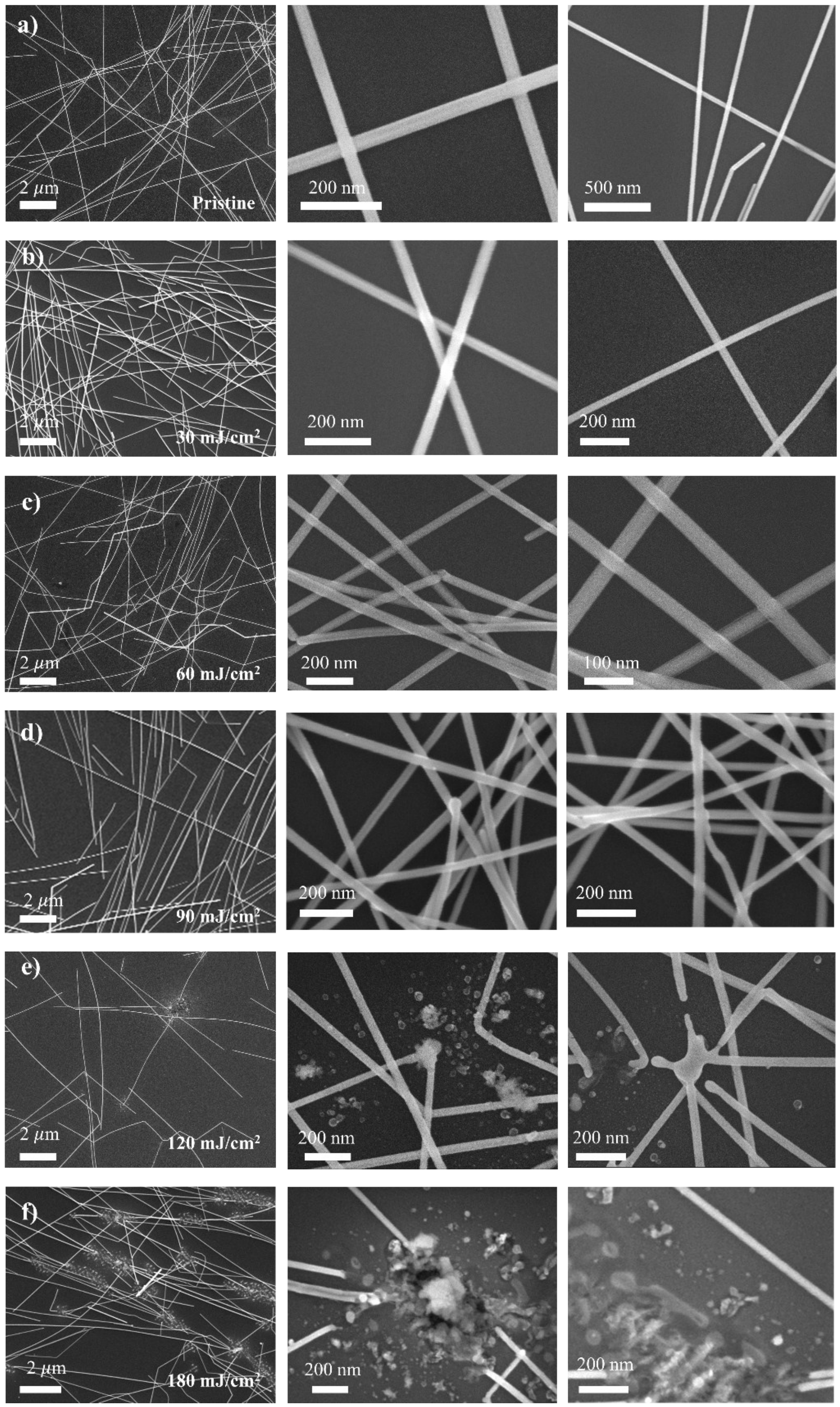

Figure S1 | FE-SEM images of AgNWs after the fs laser irradiation. SEM images show AgNWs after fs laser irradiation varying laser fluence (*F*) at a fixed scan speed (*v*) = 0.1 mm/s.

◎ **TEM images of AgNWs before laser irradiation**

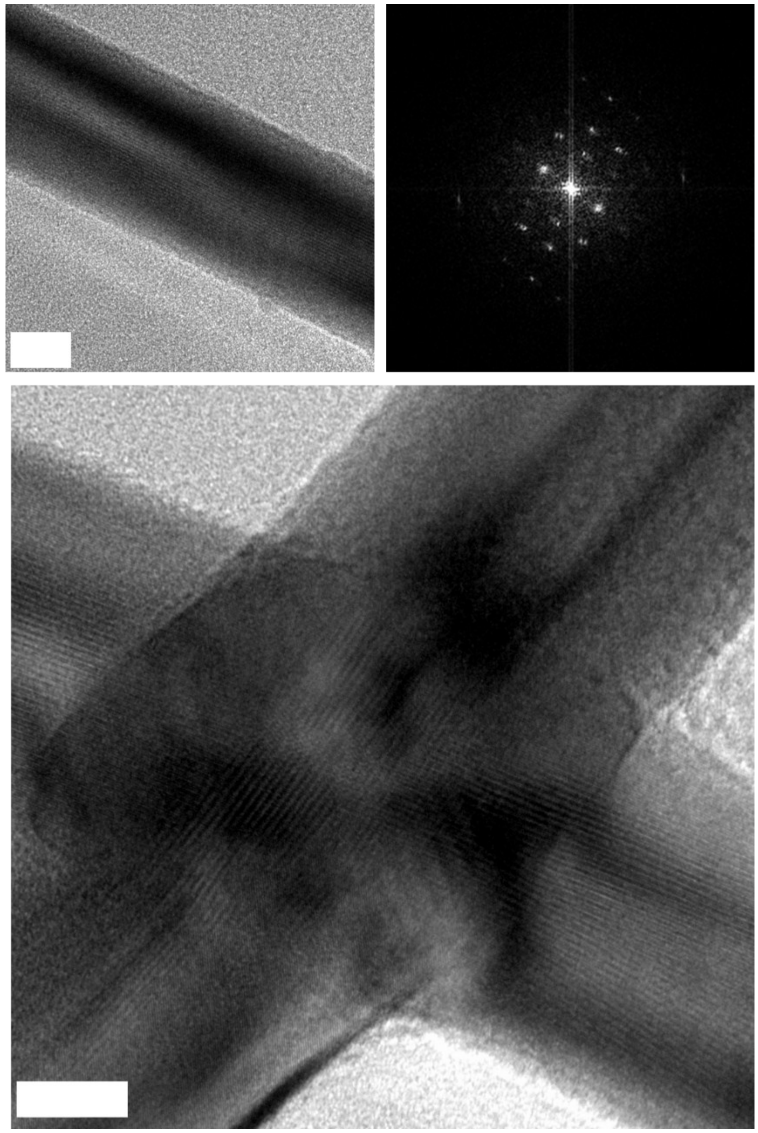

Figure S2 | TEM images of AgNWs after the fs laser irradiation. TEM images shows AgNWs before fs laser irradiation. All scale bar is 10 nm.

◎ **TEM images of AgNWs after fs laser irradiation**

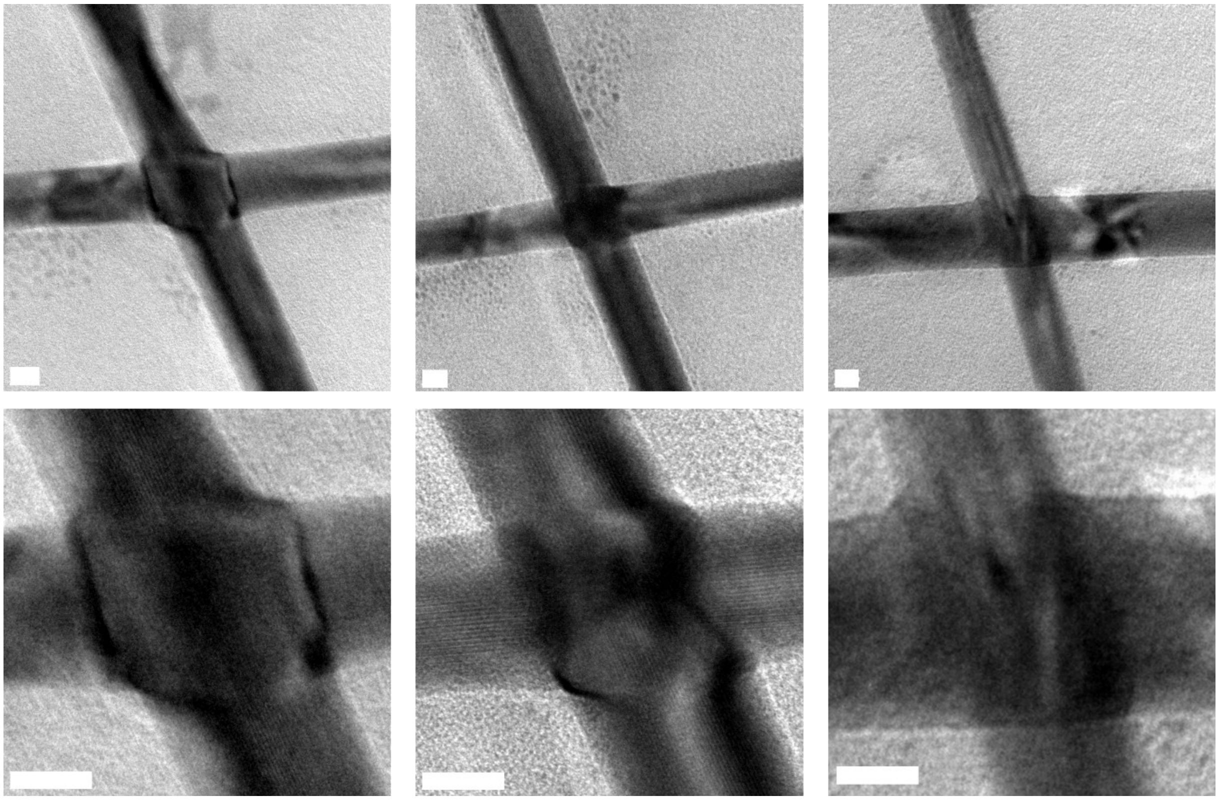

Figure S3 | TEM images of AgNWs after the fs laser irradiation. TEM images shows AgNWs before fs laser irradiation at F = 90 mJ/cm^2 and v = 0.1 mm/s. The images was randomly obtained at three different position. All scale bar is 10 nm.

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].

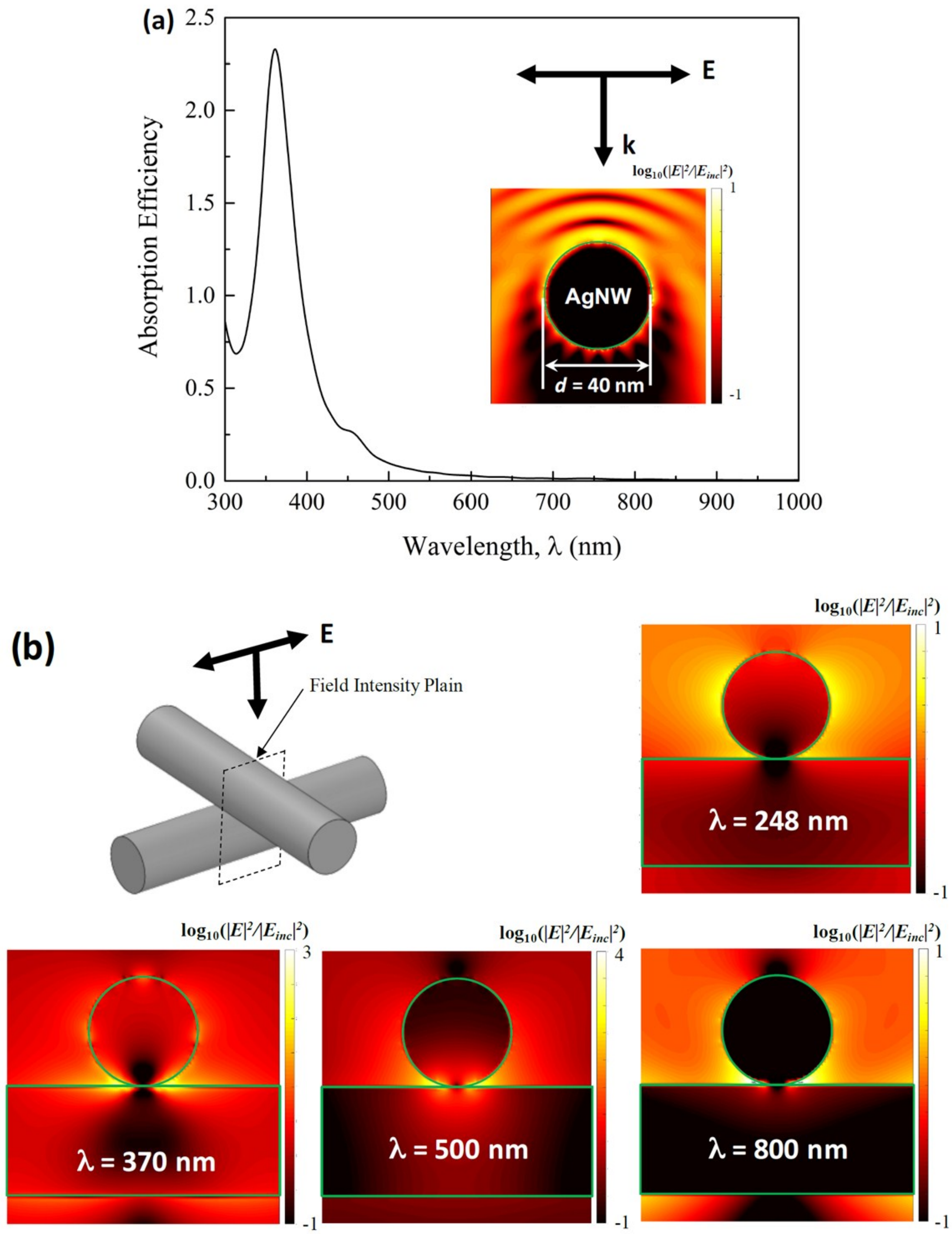

Figure S4 (a) Absorption efficiency of a free-standing AgNW under the illumination of light with transverse-magnetic polarization. Inset shows square of the electric field when LSP occurs; (b) Square of the electric field in the vicinity of junction between two perpendicular AgNWs at different wavelengths.

◎ **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 $[J/m^3K^2]$ {Lin, 20(2	63.3
G $[W/m^3K]$ 2	0.2×10^{17}
C_l $[J/m^3K]$ 3	2.44×10^{6}
k_0 $[W/mK)$ 1	193

1. Z. Cheng, L. Liu, S. Xu, M. Lu and X. Wang, *Scientific Reports*, 2015, **5**, 10718.
2. Z. Lin, L. V. Zhigilei and V. Celli, *Phys Rev B*, 2008, **77**, 075133.
3. D. R. Lide, *Handbook of Chemistry and Physics, 84th Edition*, CRC Press. Boca Raton, Florida, 2003.