

Supporting Information

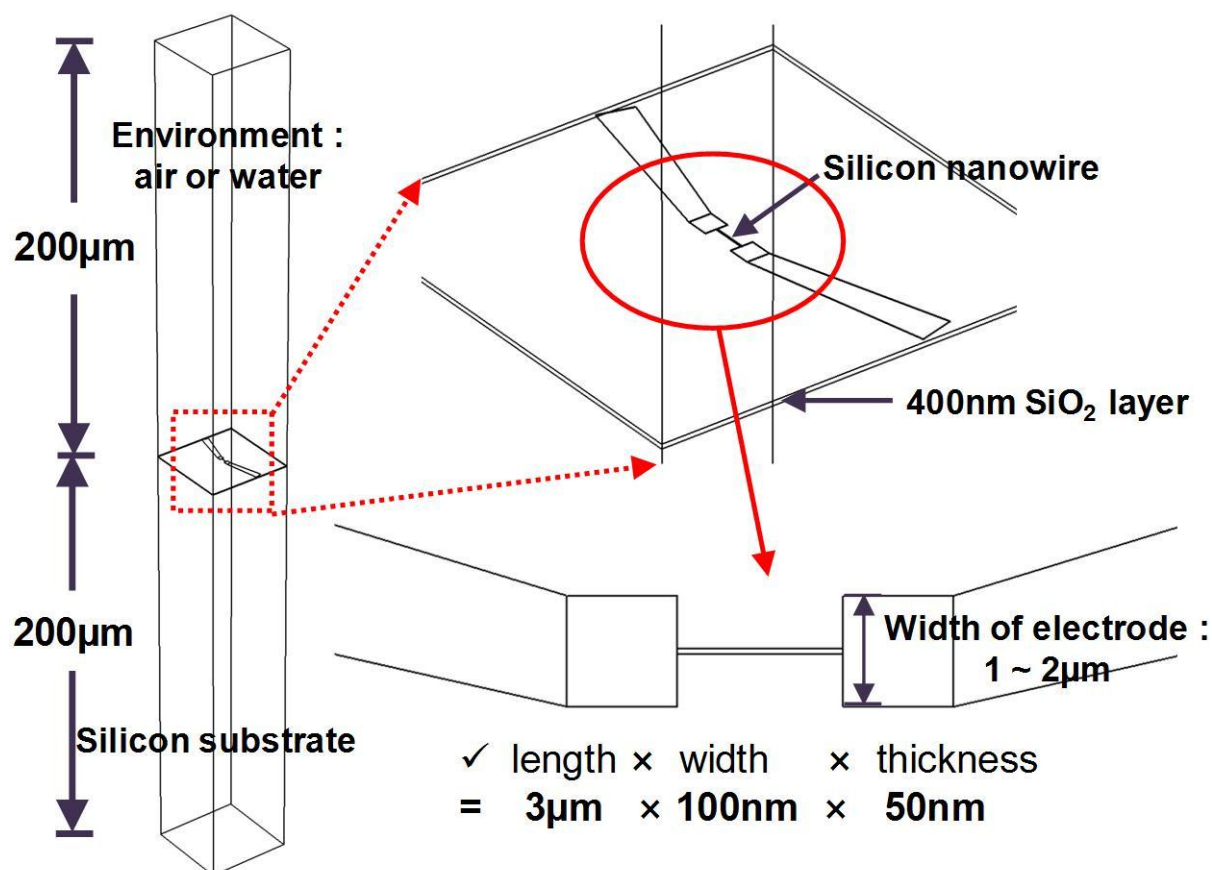


Fig. S1 Model for the numerical simulation of SiNW Joule heating: 200 μm long square (40 μm × 40 μm) cylinders were defined as silicon substrate and environment. 400 nm thick square of silicon dioxide layer was defined on the silicon substrate. SiNW with 100 nm width, 3 μm length, and 50 nm thickness was used for simulation.

Fig. S2 shows the normalized maximum temperature of the SiNW versus time for various frequencies of AC voltage by using a numerical simulation with COMSOL Multiphysics software. The maximum temperature is normalized by the equation below:

$$T_{\text{normalized}} = \frac{T_{\text{max}} - 293.15\text{K}}{T_{\text{DC,max}} - 293.15\text{K}}$$

where T_{max} is the maximum temperature of the SiNW under AC voltage and $T_{\text{DC,max}}$ is the maximum temperature of the SiNW for a DC bias identical to the amplitude of the AC voltage. The frequency of temperature fluctuation is twice of the AC frequency, because Joule heating occurs by both positive and negative voltages.

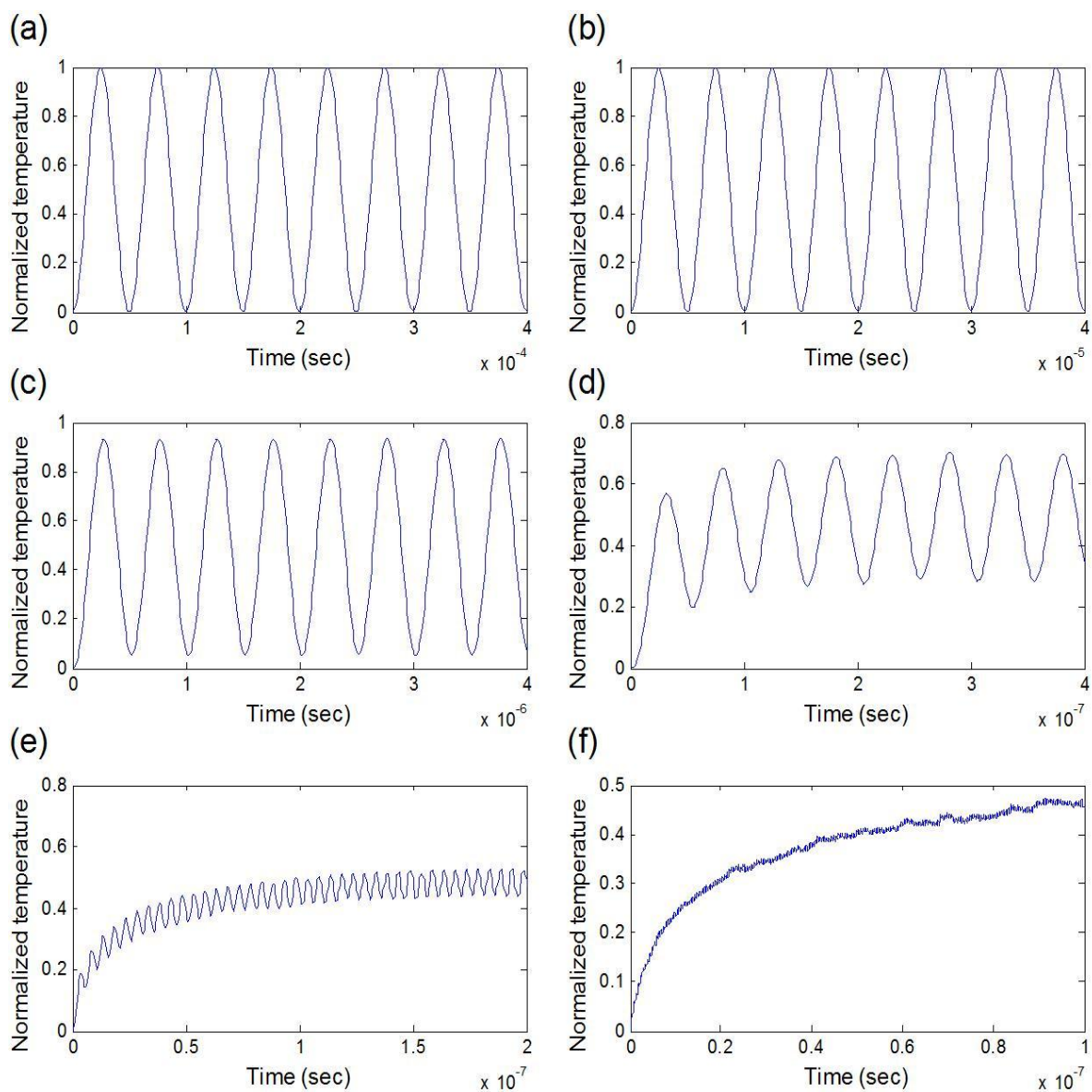


Fig. S2 The normalized temperature of SiNW by AC Joule heating with different frequencies: (a) 10 kHz, (b) 100kHz, (c) 1MHz, (d) 10MHz, (e) 100MHz, and (f) 1GHz.