

Characterizing the effects of temperature on the thermal vibration properties of individual nanowires

Supplementary Material

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Figure S1. Low-magnification HAADF-STEM image of the nanowire installed in the heating holder.

Square-wave calculation details:

The data in Fig. S2 was obtained by generating a square-wave function and convoluting it with a Gaussian function. The calculations were performed using GNU Octave. The following code reproduces the data in the figure:

```
a=1.23; f=2.5; phi=90; c=0.5; N=1000; DT=0.01;  
t=linspace(0, (N-1)*DT, N);  
y=a*square(2*pi*f*t+phi/180.*pi, duty);  
y=conv(y, gaussian(N, c), "same");  
ft=abs(fft(y));
```

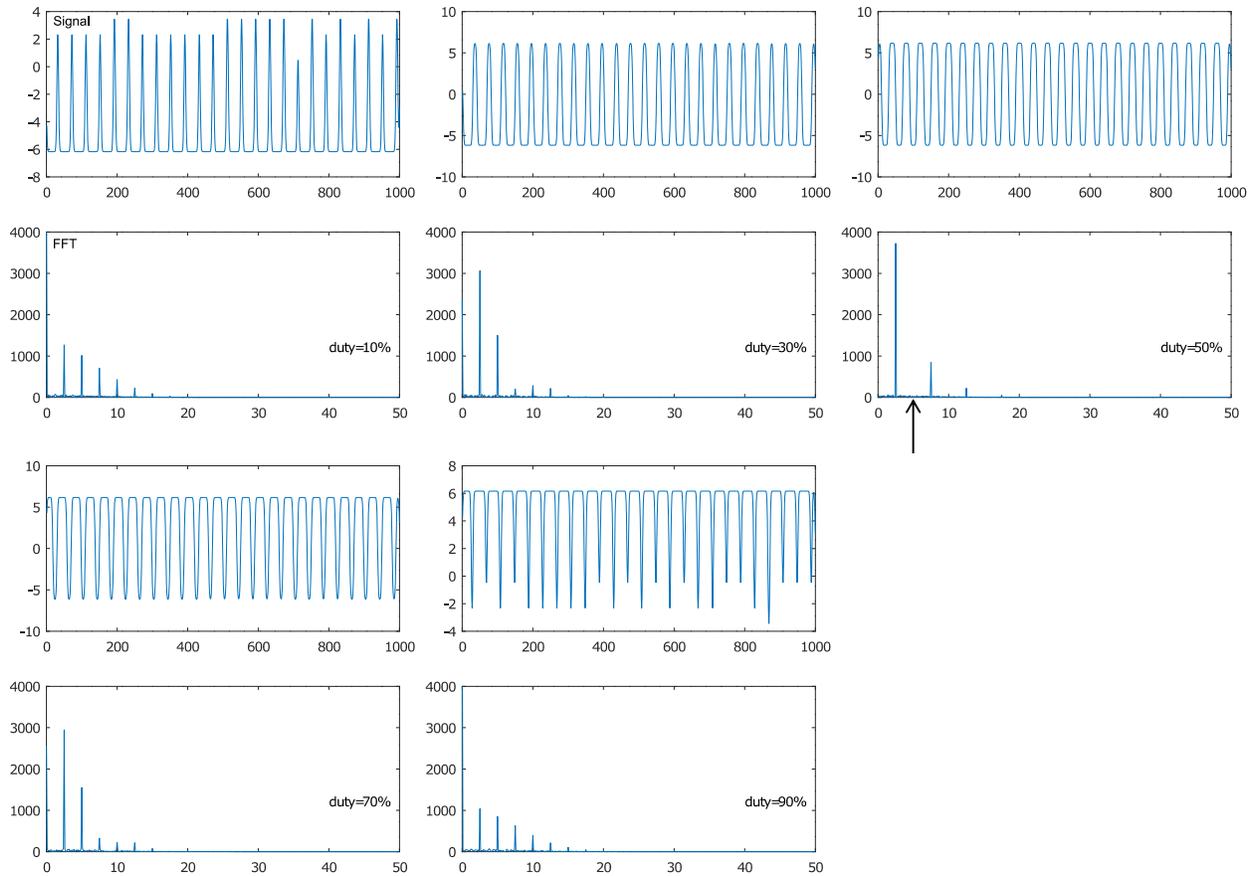


Figure S2. Signal and FFT plot pairs for a smoothed square-wave function with varying duty cycle. Note the lack of even harmonics for the 50% duty-cycle case (arrowed).

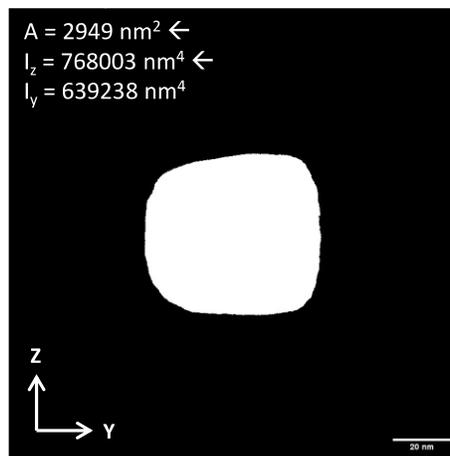


Figure S3. Tomography-derived cross-section of the nanowire. The cross-section area A and area moments of inertia along the two directions $I_{x/y}$ calculated using this figure are overlaid. The calculations were performed using ImageJ.

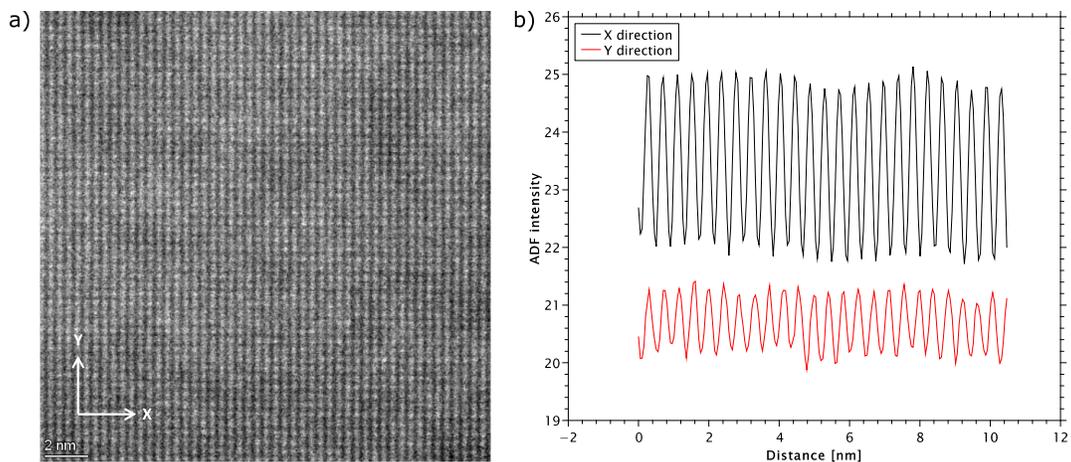


Figure S4. a) High-resolution HAADF-STEM image of the area of the nanowire near the end of the Ta needle. The nanowire is tilted along the (100) direction. The image was taken after transferring the nanowire to a double-tilt holder, since the heating holder used is single-tilt. b) Averaged plots along the indicated directions in a). The two signals were manually offset for clarity.

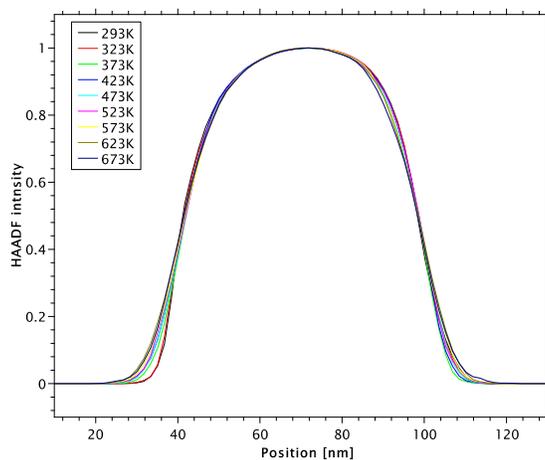


Figure S5. Averaged profiles across HAADF-STEM images of the nanowire at various temperatures.