Science Advances

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Supplementary Materials for

Approaching the ideal elastic strain limit in silicon nanowires

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Published 17 August 2016, *Sci. Adv.* **2**, e1501382 (2016)
DOI: 10.1126/sciadv.1501382

The PDF file includes:

- fig. S1. Monotonic tensile straining of a VLS-grown Si nanowire under an optical microscope.
- fig. S2. Additional details about sample clamping and gauge length/strain measurement.
- Legends for movies S1 to S5

Other Supplementary Material for this manuscript includes the following:
(available at advances.sciencemag.org/cgi/content/full/2/8/e1501382/DC1)

- movie S1 (.mp4 format). Monotonic tensile test of a VLS-grown Si nanowire inside a scanning electron microscope (as shown in Fig. 2, A to G); video speed is played at ~3× speed.
- movie S2 (.mp4 format). Loading–partially unloading tensile test of a VLS-grown Si nanowire with increased strain values until finally fractured at a stress of ~20 GPa; video speed is played at ~10× speed.
- movie S3 (.mp4 format). Loading–fully unloading tensile test of a VLS-grown Si nanowire inside a scanning electron microscope (as shown in Fig. 2, H and I); video speed is played at ~9× speed.
- movie S4 (.mp4 format). Loading–fully unloading tensile test of a VLS-grown Si nanowire in ambient environment under an optical microscope (as shown in Fig. 3); video speed is played at ~8× speed.
- movie S5 (.mp4 format). Monotonic tensile test of a top-down etched Si nanowire (as shown in Fig. 4, B and C); video speed is played at ~2× speed.

One of the experiments showing max strain value ~16% at room temperature

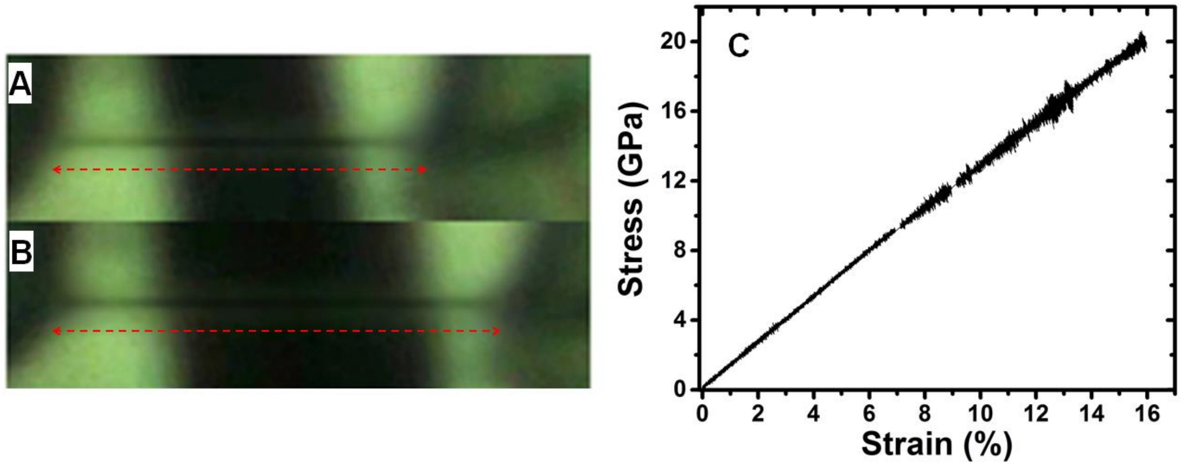

fig. S1. Monotonic tensile straining of a VLS-grown Si nanowire under optical microscope: (**A**), original status before test. (**B**), the status showing the maximum strain of ~16% (corresponding fracture stress ~20 GPa; the straining rate in this experiment was 0.0017 s^{-1}). (**C**), the corresponding stress vs. strain curve (note that the contrast in the optical images was slightly enhanced).

More description about the sample clamping and strain measurement

As briefly discussed in the “Materials and Method” section of the paper, for high-magnification SEM imaging of the Si nanowire samples under in situ tensile testing, we used standard electron beam voltage (20-30kV) to achieve high resolution and best video quality, while used low e-beam voltage (2-10kV) for imaging the glue clamping points (*e.g.* Fig. 1E) and defining the tensile gauge length of the nanowire samples before testing.

To better capture the glue boundaries of the clamping points, we can also tilt the sample stage while imaging the sample and clamping points at lower e-beam voltage, such as shown in fig. S2 below. By imaging the sample at 10kV with a slightly tilting angle (~10 degree), we can obtain a more clear image of the glue bonding areas (fig. S2B) than the normal view taken at 30kV (fig. S2A), allowing us to precisely define the clamping boundaries and mark the gauge length for strain measurement (as shown in fig. S2 C).

To ensure there is no interfacial sliding between the nanowire sample and the clamping glue, we intentionally left the both ends of nanowire samples exposed out of the clamping glue, and checked their exposed lengths before and after each test, as shown in fig. S2D-E. If their remaining lengths were not changed at both ends, we can confirm no sliding between the nanowire and the glue clamping.

In addition, we can further tilt the sample stage to very high angle (*e.g.* ~80 degree in fig. S2F), even vertically (fig. S2G), to obtain a side view of the sample and the stage and evaluate the sample alignment and sample-stage surface interaction and distances, to make sure the strain measurement accurate and reliable.

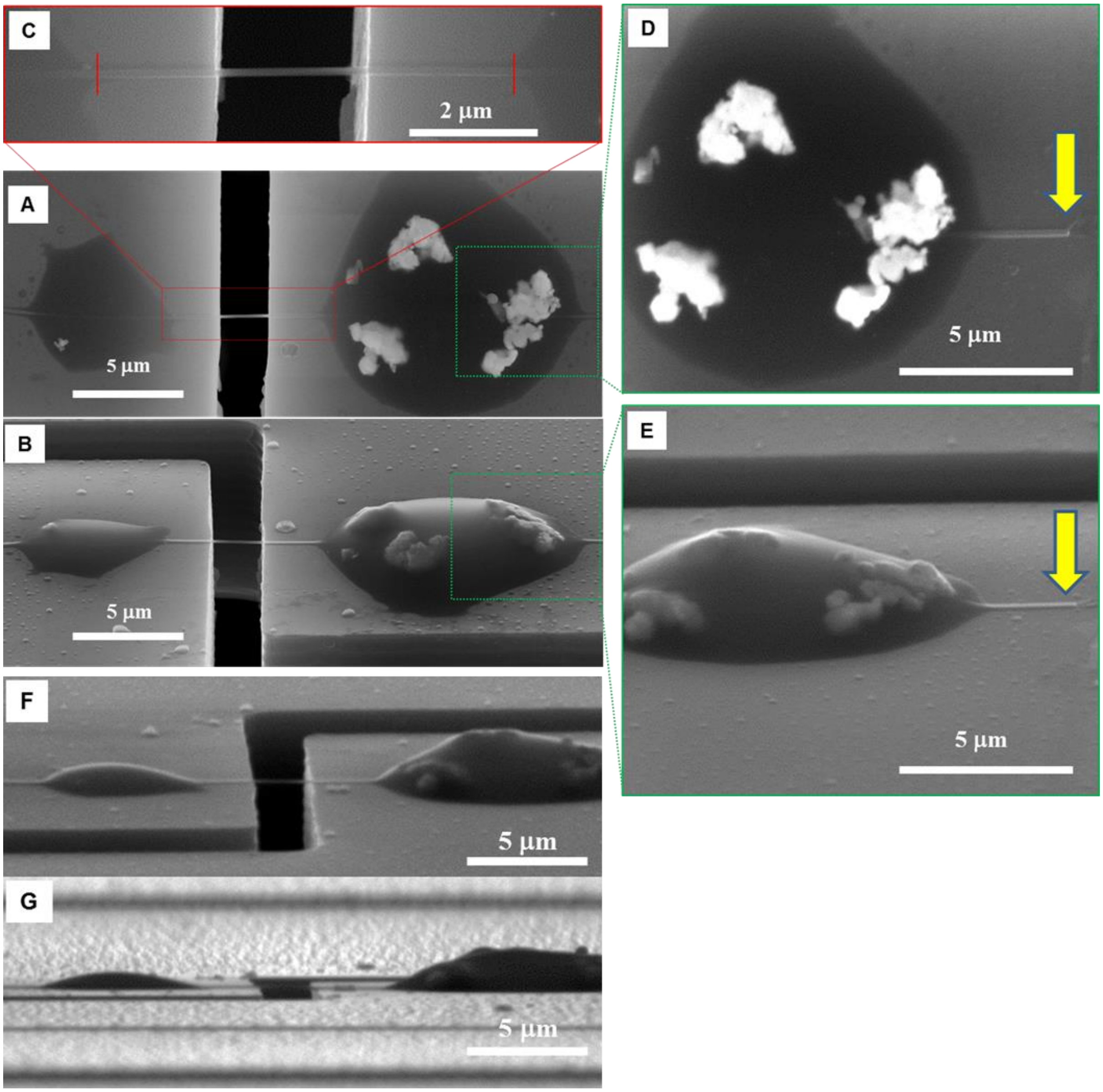

fig. S2. Additional details about sample clamping and gauge length/strain measurement: (**A**) normal SEM image of a clamped Si nanowire taken at 30kV. (**B**) slightly tilted view (~10 degree) of the clamped Si nanowire imaged at 10kV, for defining the gauge length, as the red markers shown in (**C**). (**D**) and (**E**) zoom-in views of the exposed nanowire ends (as indicated by the yellow arrows) to ensure no sliding between the sample and the clamping glue. (**F**) and (**G**) side views of the clamped nanowire with high tilting angle (~80 degree, **F**) to nearly vertical (**G**), showing high quality clamping and sample alignment.

Captions for Supplementary Movies

movie S1. Monotonic tensile test of a VLS-grown Si nanowire inside SEM (shown in Fig. 2A-G); video speed is played at ~3× speed.

movie S2. Loading-partially unloading tensile test of a VLS-grown Si nanowire with increased strain values until finally fractured at stress ~20GPa; video speed is played at ~10× speed.

movie S3. Loading-fully unloading tensile test of a VLS-grown Si nanowire inside SEM (shown in Fig. 2H-I); video speed is played at ~9× speed.

movie S4. Loading-fully unloading tensile test of a VLS-grown Si nanowire in ambient environment under optical microscope (shown in Fig. 3); video speed is played at ~8× speed.

movie S5. Monotonic tensile test of a top-down etched Si nanowire (shown in Fig. 4B-C); video speed is played at ~2× speed.