

Supplementary material

The as-grown defect-free gold nanowires were transferred on a Si wafer patterned with 10 μm wide and 1.5 μm deep micro-trenches by scratching the growth substrate against it. The nanowires were then thoroughly attached by depositing carbon from the residual gas in a SEM chamber. While SEM images do not show any damage or deterioration of the nanowire neither by scratching nor by the carbon gluing, X-ray diffraction tells otherwise. Rocking scans of the Au 111 Bragg peak were recorded in steps of 1 μm along the nanowire presented in the SEM image in Fig. S1(a). The integrated intensity of each rocking curve as a function of the measurement position along the nanowire is displayed in Fig. S1(b) revealing significant changes of the Q_z value of the Bragg peak for positions where the nanowire crosses the Si ridges and, thus is thoroughly clamped. Coherent X-ray diffraction patterns (CXDPs) recorded on the left Si support, the center of the suspended nanowire, and at the right Si support are presented in Fig. S1(c)–(e). While the CXDP recorded on the suspended nanowire part exhibits a well-defined Bragg peak with pronounced size fringes, distorted patterns are recorded at or close to the Si ridges indicating a deformed and strained object. The CXDPs at the clamping positions are further shifted along Q_x suggesting nanowire bending.

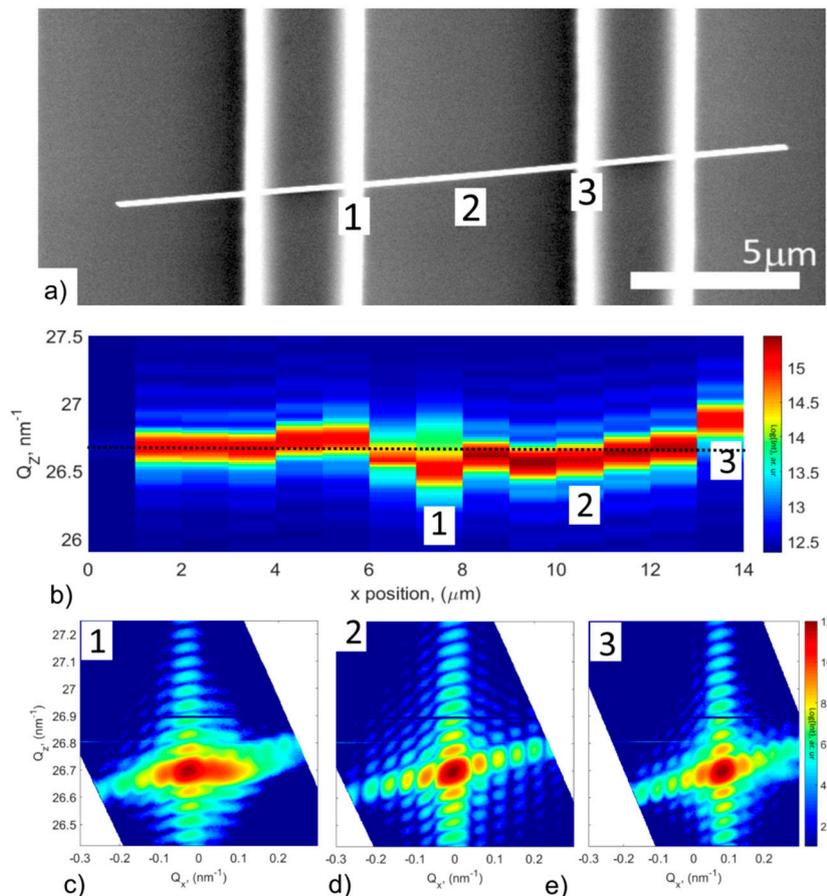


Figure S1. a) SEM image of the selected Au nanowire before the in-situ three-point bending test. b) Au 111 Bragg peak position recorded along the nanowire in steps of 1 μm . Reciprocal space maps

recorded c) at the left-hand side Si support, d) at the center of the suspended Au nanowire, and e) at the right-hand side Si support.

Besides coherent X-ray diffraction, Laue microdiffraction patterns were recorded along a similar Au nanowire at the BM32 beamline at the European Synchrotron (ESRF) in Grenoble (France) where the incident polychromatic X-ray beam was focused down to $500\text{ nm} \times 500\text{ nm}$ using a pair of Kirkpatrick-Baez mirrors. Here, the Au nanowire crosses multiple $2\text{ }\mu\text{m}$ wide and $1\text{ }\mu\text{m}$ deep Si micro-trenches. The Laue microdiffraction patterns show round diffraction spots for all suspended nanowire parts while streaked Laue spots are observed at positions where the nanowire is supported and clamped at the Si supports (Fig. S2). Like for the CXD analysis, it equally suggests that the nanowire is strained and deformed at each clamping position.

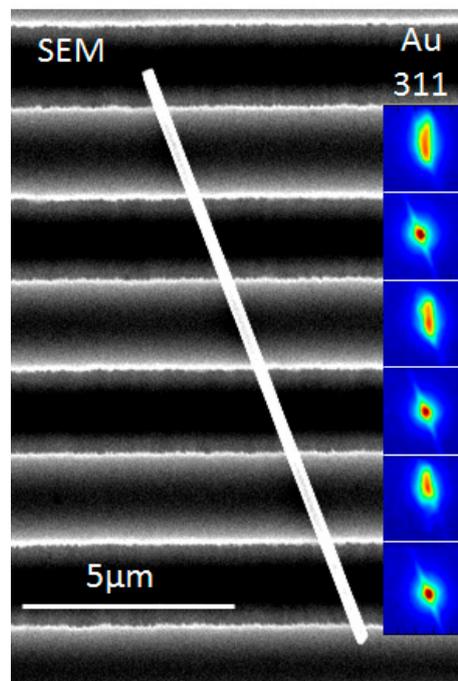


Figure S2. SEM image of gold nanowire lying across Si trenches overlaid with the Au 311 Laue spot measured along the nanowire.

These observations clearly evidence that the preparation process for the in-situ three-point bending tests affects the initial strain state of the Au nanowires. The nanowire degradation may originate either from the scratching of the growth substrate against the patterned Si substrate to transfer the nanowires or from the carbon deposited on the nanowire to thoroughly clamping them to the Si supports. This kind of deterioration of nanowires by the preparation and clamping procedure is an important aspect for any kind of future devices based on nanowires that have to be fixed and connected to a substrate. Further investigations are clearly required to optimizing the process and reducing the nanowire deformation.