

Supplementary Information

Copper Nanowires Synthesis by Directed Electrochemical Nanowire Assembly

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1. Electrical characterization of the grown copper nanowires

The I - V measurement of a single nanowire of diameter approximately 300 nm shows a linear increase (see Fig. S1), indicating an ohmic behavior at room temperature.

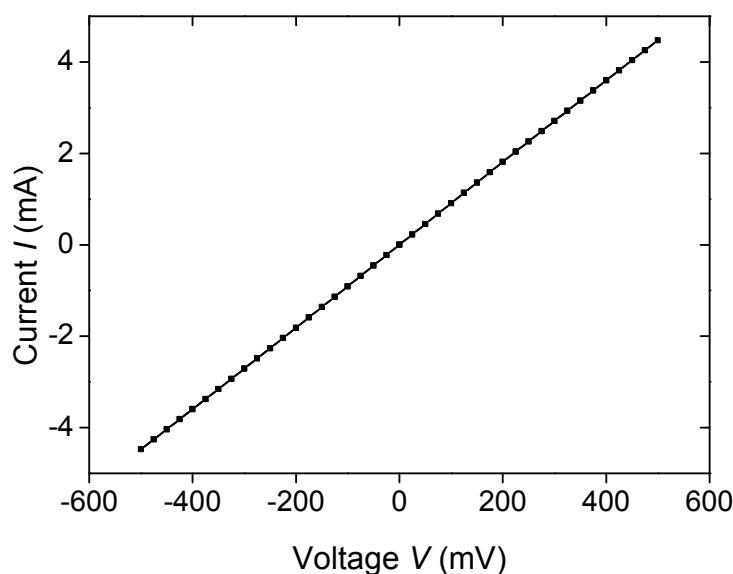


Fig. S1: I - V characteristic of the grown copper nanowire. The curve reveals ohmic behavior.

2. Elemental analysis of the grown nanowires

Elemental analysis was carried out using energy dispersive X-ray spectrometry (EDX, Philips XL 30 ESEM-FEG). Fig. S2a is a SEM image of a grown wire at a cupric ion concentration of 1.0 mM, a voltage amplitude $V_{pp} = 20$ V and a frequency $f = 750$ kHz bridging an electrode distance of 40 μm . The average diameter of the wire was measured from SEM images and is around 600 nm. In Fig S2b-d backscatter electron images of the morphology and surface composition of the surface including the electrode and wire is shown. EDX spectra of the different areas are shown in Fig S2e-g, respectively. The low peak of Au in the EDX spectrum in Fig. S2e identified in the area of (b) indicates small amounts of gold deposited as 20 nm electrode layer. Peaks of copper

(Fig. S2f) were found in the area of Fig. S2c and can be attributed to the grown wire, which reveals that the wire is made of copper. A sharp peak of Si and a low peak of O were found in all EDX spectra (Fig. S2e-g) and can be attributed to the Si/SiO₂ substrate.

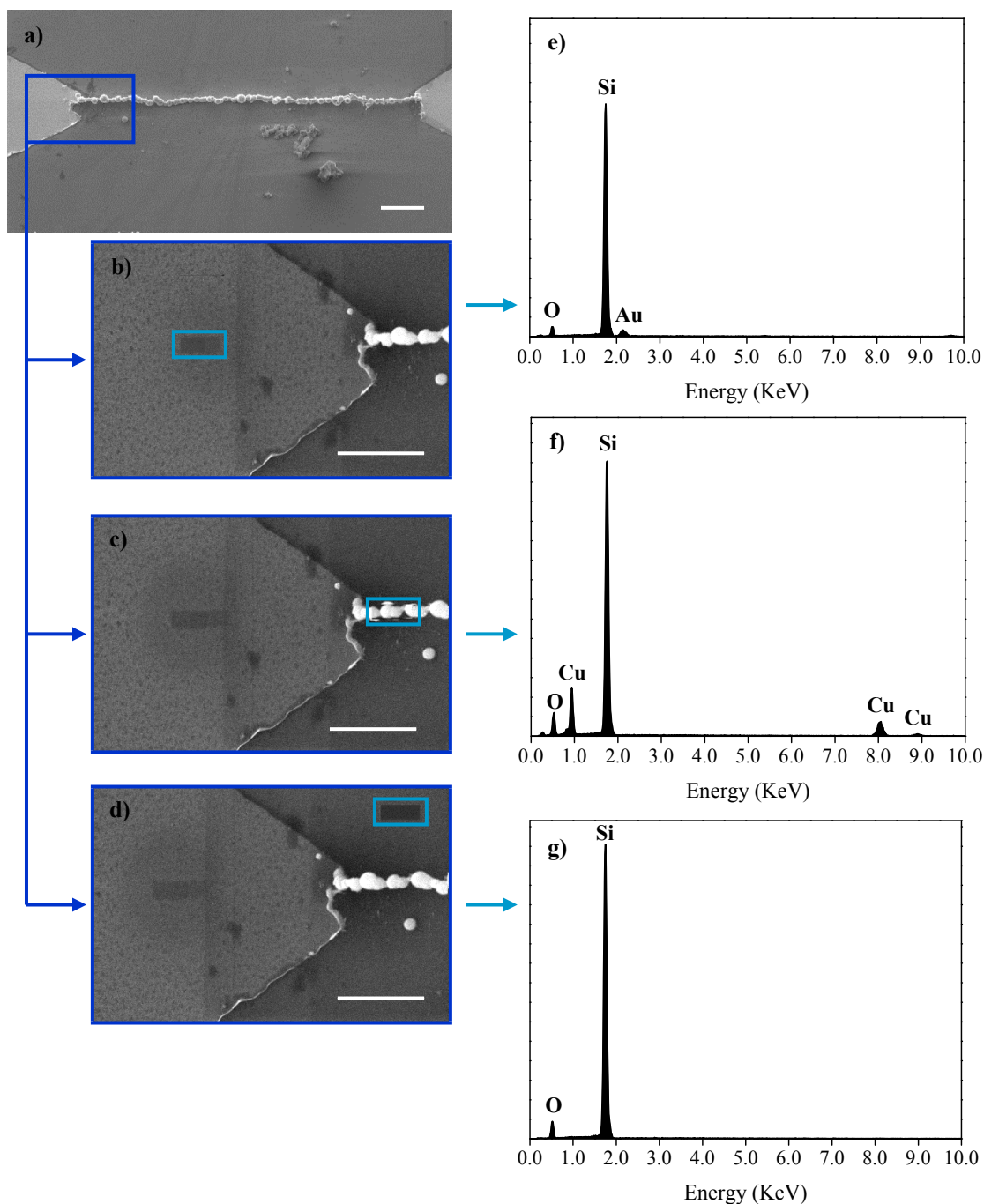


Fig. S2: EDX analysis of a grown nanowire. (a) SEM image of a synthesized nanowire with a $\text{Cu}(\text{NO}_3)_2$ concentration of 1.0 mM, a voltage amplitude $V_{pp} = 20$ V and a frequency $f = 750$ kHz bridging an electrode distance of $40 \mu\text{m}$, (b-d) backscattered electron image of SEM, and (e-g) corresponding EDX spectrum of the respective position. The areas in (b-d) correspond to the respective elemental analyses of (e-g). Si and O were detected at all three positions, which were expected since the growth was carried out on a silicon wafer with a 400 nm oxide layer substrate. The Au peak in (e) was attributed to the 20 nm thick gold layer of the electrode. The Cu peaks in (f) were due to the grown wire from aqueous copper(II)-nitrate solution revealing that the wire is made of copper. Scale bars $5 \mu\text{m}$.