Silicon nanowire aqueous dispersions for processing into macroscopic network materials

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Supplementary Information 1:

The float catalyst chemical vapor deposition (FCCVD) reactor comprises a chamber for producing catalyst gold nanoparticles by evaporation, a reaction tube, and a collection chamber. The nanoparticles were aerosolized through joule heating of a gold source at around 1500 °C. SiH_4 gas and hydrogen gas were added just before the reactor tube. The reactor temperature was maintained at 650 °C. During the growth of SiNWs in the reaction tube, the structures were collected downstream by filtration using standard porous paper[1].

Fig. S1. a) A diagram of the synthesis process illustrating the catalytic decomposition of SiH_4 in the presence of an aerosol containing Au particles[1].

Supplementary Information 2:

SiNWs suspensions of three different pHs, showing the stability of the nanoparticles in water.

Fig. S2. 0.05 wt.% SiNWs aqueous suspensions at pH 3.6, 7.0 and 10.4 (respectively).

Supplementary Information 3:

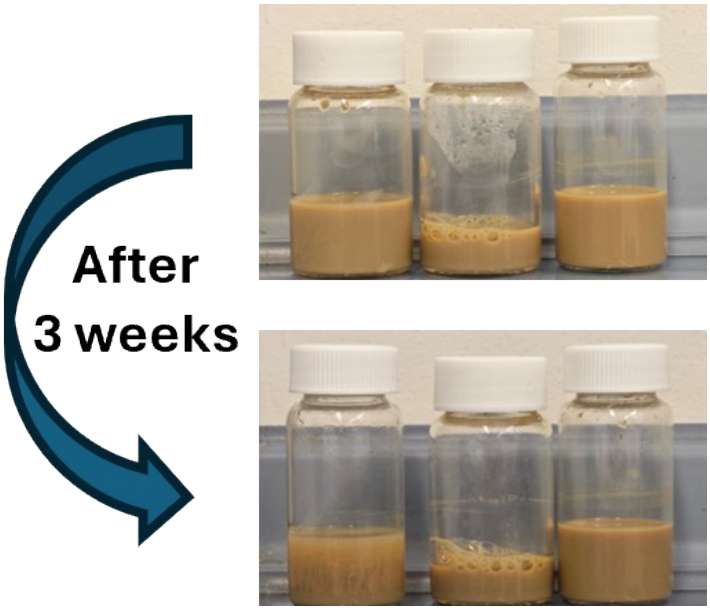

Fig. S3. Photo of the stability of 0.05 wt.% SiNWs' suspensions in EtOH, deionized water with 0.2 wt.% CTAB and pH 10.4 before and after 3 weeks

Supplementary Information 4:

Centrifugation of a 0.1 wt.% of SiNWs and 0.2 wt.% CTAB aqueous suspension. Supernatant concentration estimated by UV-vis spectroscopy is 52 µg mL^{-1} and at the bottom there are visible the SiNW aggregates with individualized wires.

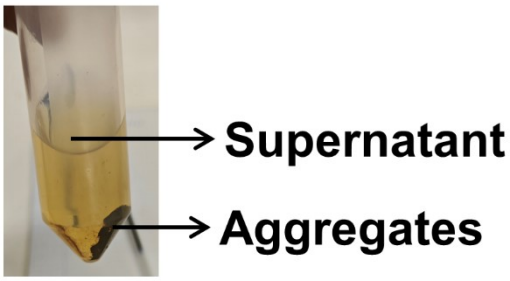

Fig. S4. Centrifugation tube containing aggregates at the bottom and the supernatant suspension.

Supplementary Information 5:

Size measurement of suspended SiNW aggregates was performed on optical microscope images. Trainable WEKA Segmentation plugin in Fiji[2] was used to detect aggregates and segment them from the background. Size measurements were performed using Fiji software package on a total of 2746 detected aggregates.

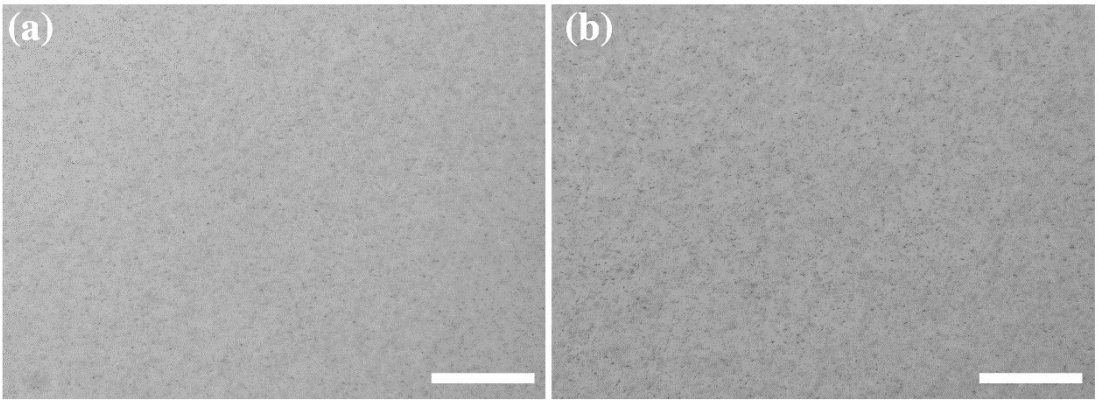

Fig. S5. Optical micrographs of 0.1 wt.% of SiNWs and 0.2 wt.% CTAB aqueous suspension top and bottom solution. Scale bar: 100 μm.

Supplementary Information 6:

Thickness measurements of the SiNWs sheets have been done using ImageJ of optical micrographs.

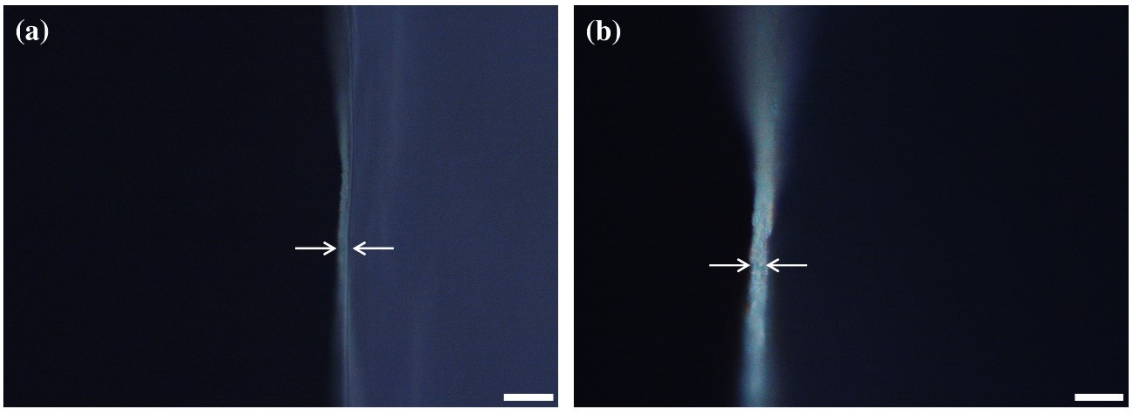

Fig. S6. Optical micrographs of the out-of-plane SiNWs sheets. Scale bar: (a) 50 µm and (b) 20 µm.

Supplementary Information 7:

The orientation of the material was studied using SAXS (SAXSpoint 5.0, Anton Paar). The measurement was performed in triplicate for 600 s using a laser with a wavelength of 0.15418 nm. Using the SAXS analysis software, the background signal is subtracted from the scattering pattern to eliminate unwanted contributions that do not originate from the sample. Subsequently, the two-dimensional (2D) scattering data are converted into one-dimensional (1D) curves through azimuthal integration.

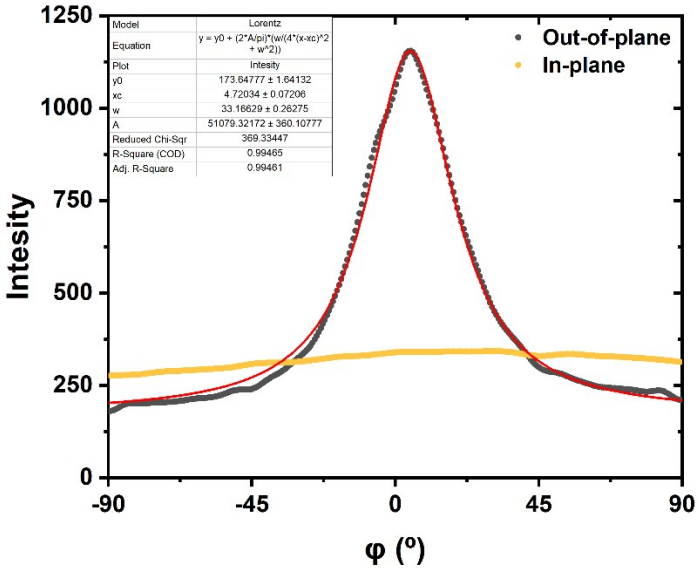

Fig. S7. Corresponding azimuthal profile of a 2D SAXS pattern obtained with the beam through the thickness (out-of-plane axis) and thought the plane (in-plane axis) of the SiNW sheet.

References:

1 R. S. Schäufele, M. Vazquez-Pufleau and J. J. Vilatela, *Mater. Horiz.*, 2020, **7**, 2978–2984.

2 I. Arganda-Carreras, V. Kaynig, C. Rueden, K. W. Eliceiri, J. Schindelin, A. Cardona and H. Sebastian Seung, *Bioinformatics*, 2017, **33**, 2424–2426.