Supporting Information

Real-Time Observation of the Solid–Liquid–Vapor Dissolution of Individual Tin(IV) Oxide Nanowires

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NANOWIRE CHARACTERIZATION

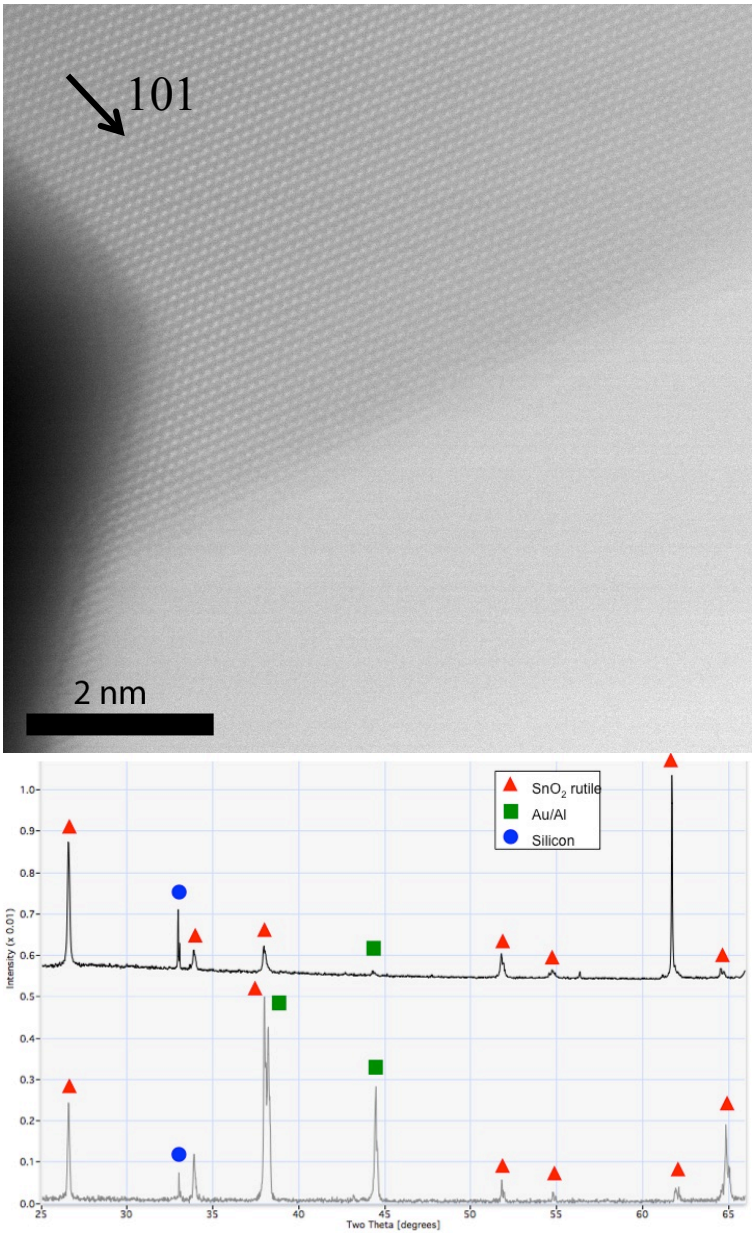

Figure S1. SnO_2 nanowire characterization. **(a)** High resolution Z-contrast STEM image of the droplet-nanowire interface. Arrow indicates the [101] growth direction. **(b)** XRD patterns from as-grown samples of SnO_2 (bottom) and In-doped SnO_2 (top) nanowires, indexed to rutile. Al and Si peaks are present due to the stage and substrate.

IN SITU TEM HEATING

Nineteen wires were monitored while undergoing Au-catalyzed dissolution, using the same heating profile. The data from these wires is provided below in Chart S1. For each wire the temperature was stepped to 450°C then ramped to 750°C at 0.2°C per second and held at 750°C until the entire nanowire had been consumed.

Wire	T_{melt} (°C)	T_{move} (°C)	D_{drop} (nm)	D_{wire} (nm)	D_{drop}/D_{wire}	D_{drop}^2 (nm^2)	D_{drop}^3 (nm^3)	dL/dt (nm/sec)	Crystallinity	Residue on Grid	Wire Thinning	Head Status	Obstruction on Surface
1	500	516	139.07	70.59	1.970	19340.46	2689678.45	0.11	single	yes	no	disconnects	yes
2	540	540	91.07	56.16	1.622	8293.74	755311.35	0.9	single	yes	no	stops	yes
3	465	473	60.71	37.45	1.621	3685.70	223759.10	0.12	single	yes	no	stops	no
4	528	539	77.38	50.14	1.543	5987.66	463325.47	2.51	single	yes	no	disconnects	no
5	//////	//////	101.27	75.12	1.348	10255.61	1038585.92	4.31	poly	yes	no	stops	yes
6	450	450	88.28	57.42	1.537	7793.36	687997.68	2.8	single	yes	no	stops	no
7	450	450	70.48	51.02	1.381	4967.43	350104.49	8.03	single	yes	no	stops	no
8	625	625	105.95	74.24	1.427	11225.40	1189331.39	1.11	single	yes	yes	stops	yes
9	516	543	105.4	102.26	1.031	11109.16	1170905.46	0.46	twinned	yes	no	stops	yes
10	563	694	99.56	57.41	1.734	9912.19	986857.99	0.18	single	yes	no	stops	no
11	450	529.4	58.65	35.17	1.668	3439.82	201745.59	1.68	single	yes	yes*	detached from wire	yes
12	563.4	578.8	109.5	76.84	1.425	11990.25	1312932.38	0.54	single	yes	yes*	detached from wire	no
13	526	582.6	84.18	63.5	1.326	7086.27	596522.41	0.3	single	yes	no	detached from wire	no
14	//////	//////	77.54	58.52	1.325	6012.45	466205.50	//////	single	//////	no	no movement	lots of residue
15	609.6	630.6	74.15	44.01	1.685	5498.22	407693.20	0.46	poly	yes	no	continues off screen	yes
16	669.6	678	112.14	57.6	1.947	12575.38	1410203.07	0.29	single	yes	no	stops	yes
17	627	696.8	37.67	35.24	1.069	1419.03	53454.82	1.24	single	yes	yes	stops	yes
18	631	682.6	99.89	58.21	1.716	9978.01	996703.63	0.48	single	yes	no	detached from wire	no
19	623.4	668	73.16	52.48	1.394	5352.39	391580.53	0.1	single	yes	yes	detached from wire	no

Chart S1. Nineteen wires were recorded undergoing SLV using the same heating profile during *in situ* heating.

Selected plots of the data analysis are shown below. Figure S2 shows data from all 15 single-crystalline nanowires, Fig. S3 shows data from only those 10 nanowires whose diameters did not change noticeably during dissolution, and Fig. S4 shows data from the remaining 5 wires whose diameters decreased during dissolution.

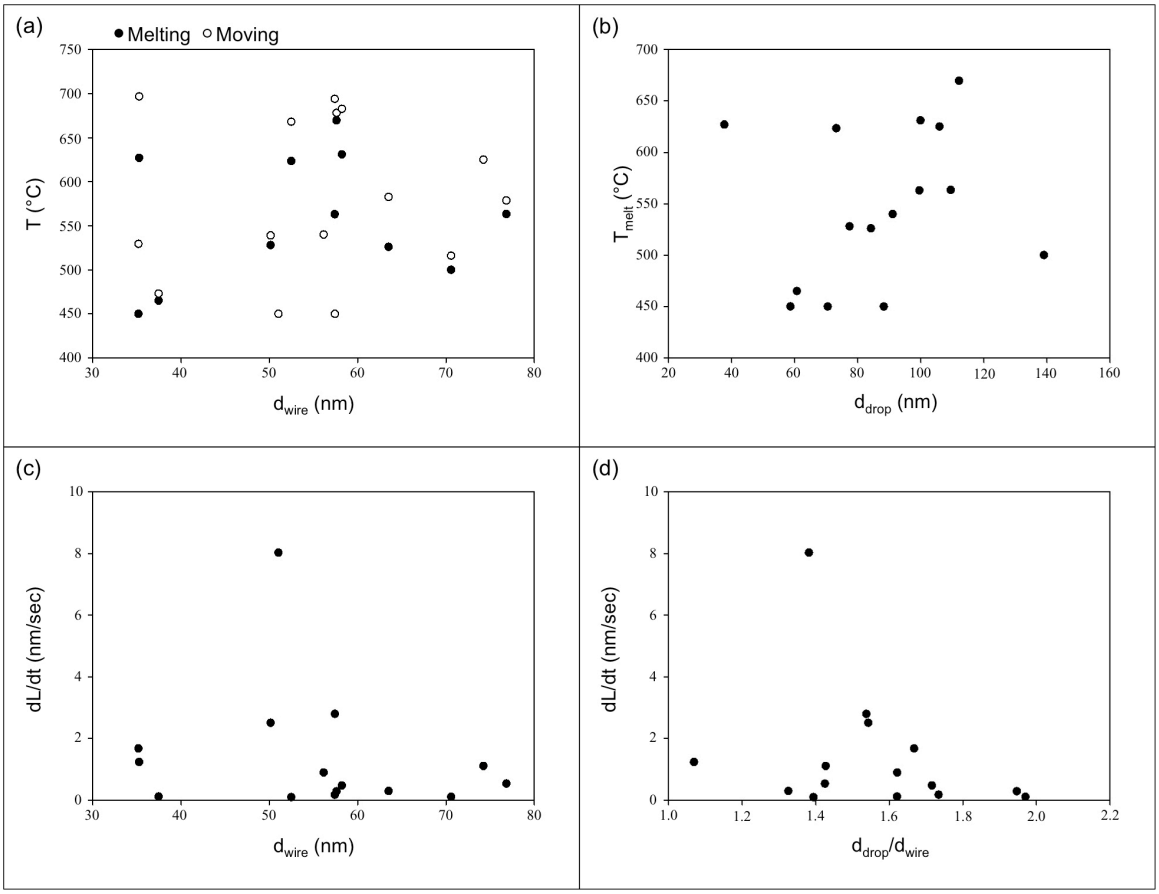

Figure S2. Kinetics of Au-catalyzed SnO_2 nanowire dissolution. Nanowires were heated from 450°C to 750°C at 0.2°C/sec, and then annealed at 750°C while dissolution rate was measured. All wires were single-crystalline. (a) Temperature at which droplet melts, T_{melt}, (dots) and is first observed to move, T_{move}, (open circles) as a function of the wire diameter. (b) T_{melt} as a function of droplet diameter. (c) Dissolution rate as a function of wire diameter. (d) Dissolution rate as a function of the ratio of droplet to wire diameter.

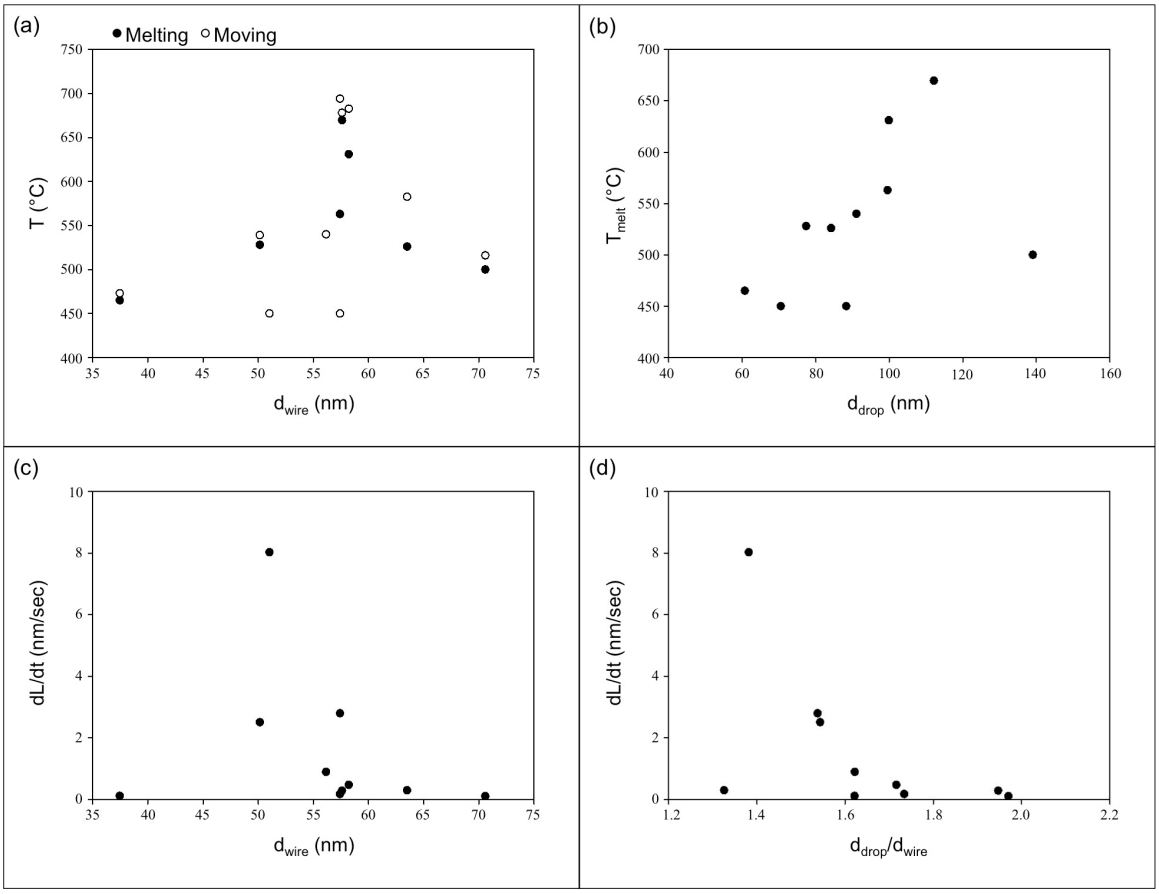

Figure S3. Kinetics of Au-catalyzed SnO_2 nanowire dissolution. Nanowires were heated from 450°C to 750°C at 0.2°C/sec, and then annealed at 750°C while dissolution rate was measured. All wires were single-crystalline **and underwent dissolution into the droplet with no observable change in wire diameter.** (a) Temperature at which droplet melts, T_{melt}, (dots) and is first observed to move, T_{move}, (open circles) as a function of the wire diameter. (b) T_{melt} as a function of droplet diameter. (c) Dissolution rate as a function of wire diameter. (d) Dissolution rate as a function of the ratio of droplet to wire diameter.

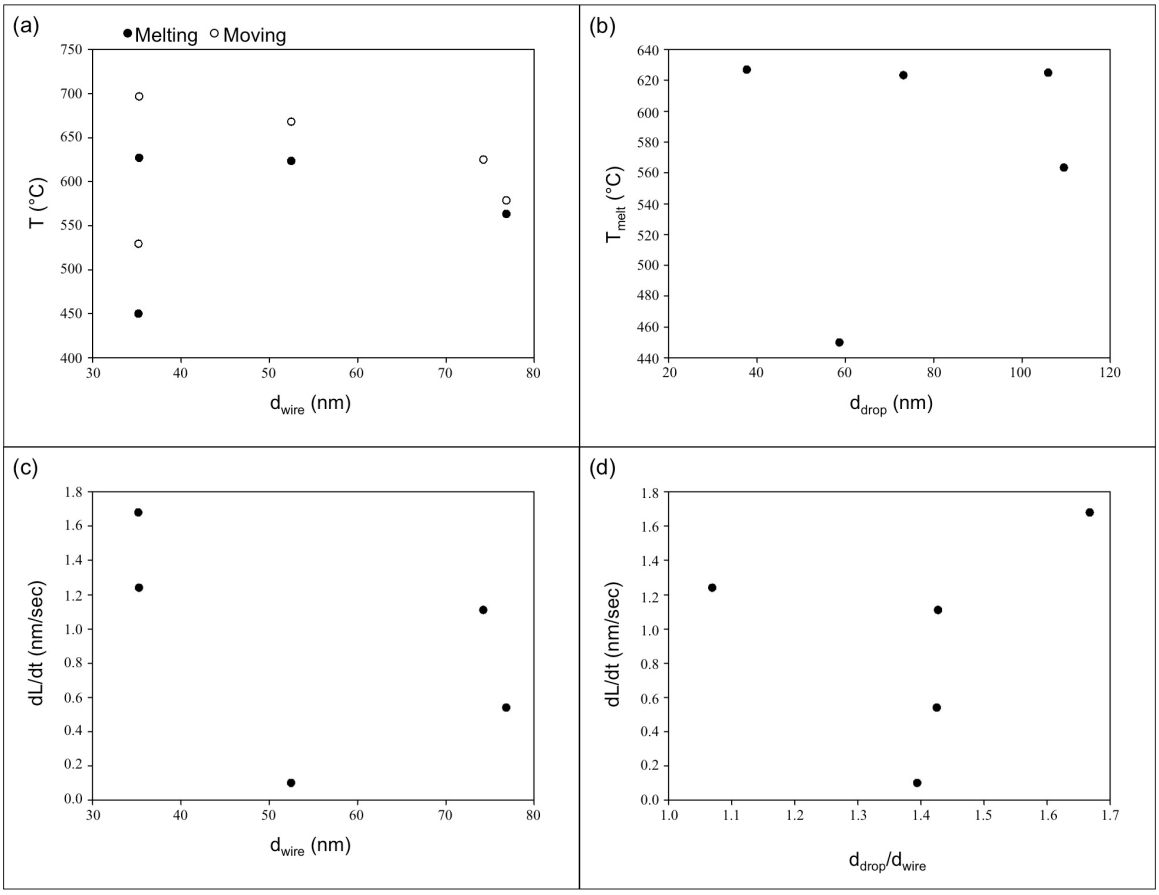

Figure S4. Kinetics of Au-catalyzed SnO_2 nanowire dissolution. Nanowires were heated from 450°C to 750°C at 0.2°C/sec, and then annealed at 750°C while dissolution rate was measured. All wires were single-crystalline **and underwent dissolution into the droplet with an observable decrease in wire diameter.** (a) Temperature at which droplet melts, T_{melt}, (dots) and is first observed to move, T_{move}, (open circles) as a function of the wire diameter. (b) T_{melt} as a function of droplet diameter. (c) Dissolution rate as a function of wire diameter. (d) Dissolution rate as a function of the ratio of droplet to wire diameter.

MOVIES

Movies S1-S5 show the raw *in situ* heating data with temperatures overlaid. Movies S6-S7 do not have overlaid temperatures because a consistent heating profile was used; each wire was set to 450°C then ramped to 700°C at 2°C per second, held at 700°C, and quenched at 8:30 minute intervals to acquire EDS spectra. Each movie was edited using iMovie software to change the file length from its original length to 5:00 minutes in order to reduce file size for submission.

Movie S1. A pure SnO_2 nanowire dissolves into the gold catalyst particle at its head. Original movie length: 53:43

Movie S2. A pure SnO_2 nanowire dissolves into the gold catalyst particle at its head while the diameter simultaneously decreases. Original movie length: 45:57

Movie S3. An In-doped SnO_2 nanowire dissolves into the gold catalyst particle at is head. Original movie length: 39:58

Movie S4. An In-doped SnO_2 nanowire dissolves into the two gold catalyst particles at either end of the wire. The two particles agglomerate at the end to form one gold nanoparticle. Original movie length: 21:52

Movie S5. An In-doped SnO_2 nanowire dissolves into the gold catalyst particle at its head. The catalyst particle is seen to start to change direction part way through. The movie ends before complete dissolution of the nanowire because the nanowire extended

onto the E-chip ceramic where the thick ceramic prevents reasonable image quality. Original movie length: 50:18

Movie S6. Pure SnO_2 nanowire dissolved by the Au catalyst droplet through SLV. The reaction was periodically quenched so that EDS spectra could be acquired during the dissolution process. Original movie length: 1:07:05

Movie S7. Pure SnO_2 nanowire dissolved by the Au catalyst droplet through SLV. The reaction was quenched periodically so that EDS spectra could be acquired during the dissolution process. Original movie length: 48:32