Supplementary Information (SI) for Energy Advances.

Microreactor Assisted Soft Lithography of Nanostructured Antimony Sulfide Thin Film Patterns: Nucleation, Growth and Application in Solid State Batteries

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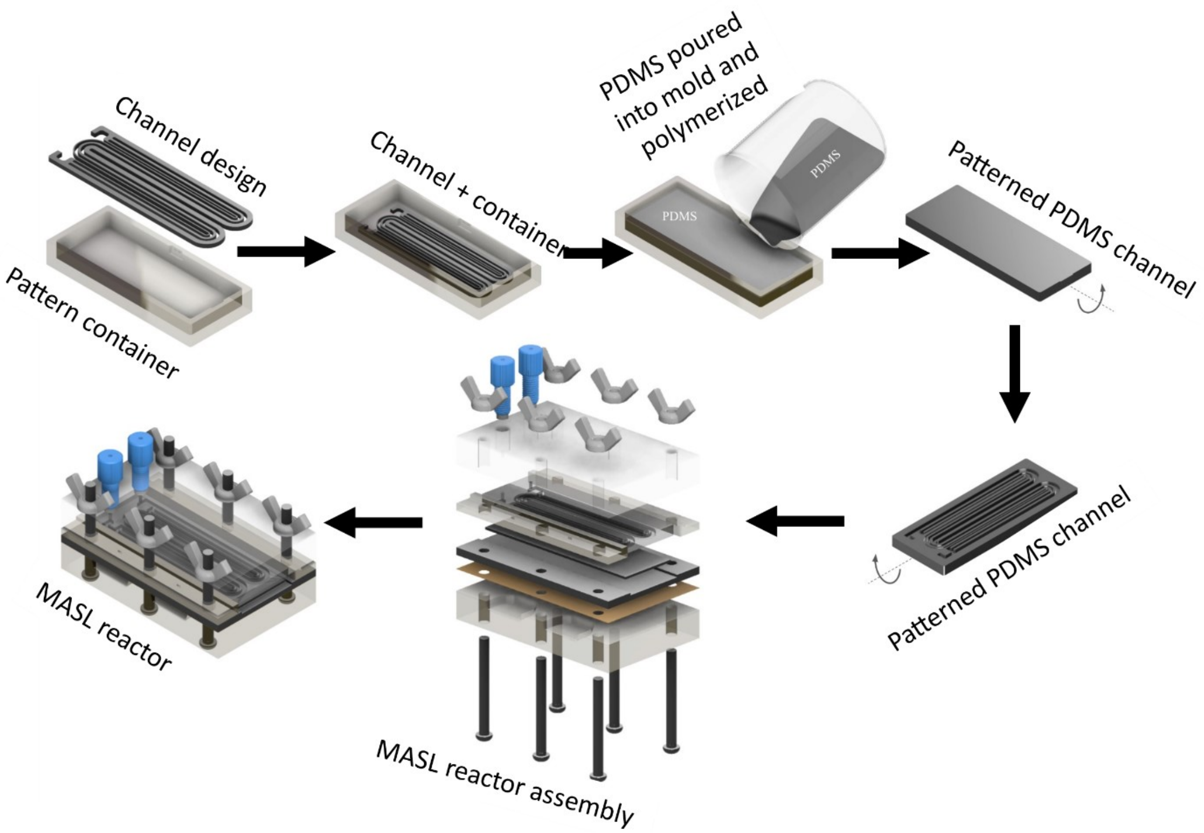


Fig S 1 Process schematics for fabricating MASL reactor assembly.

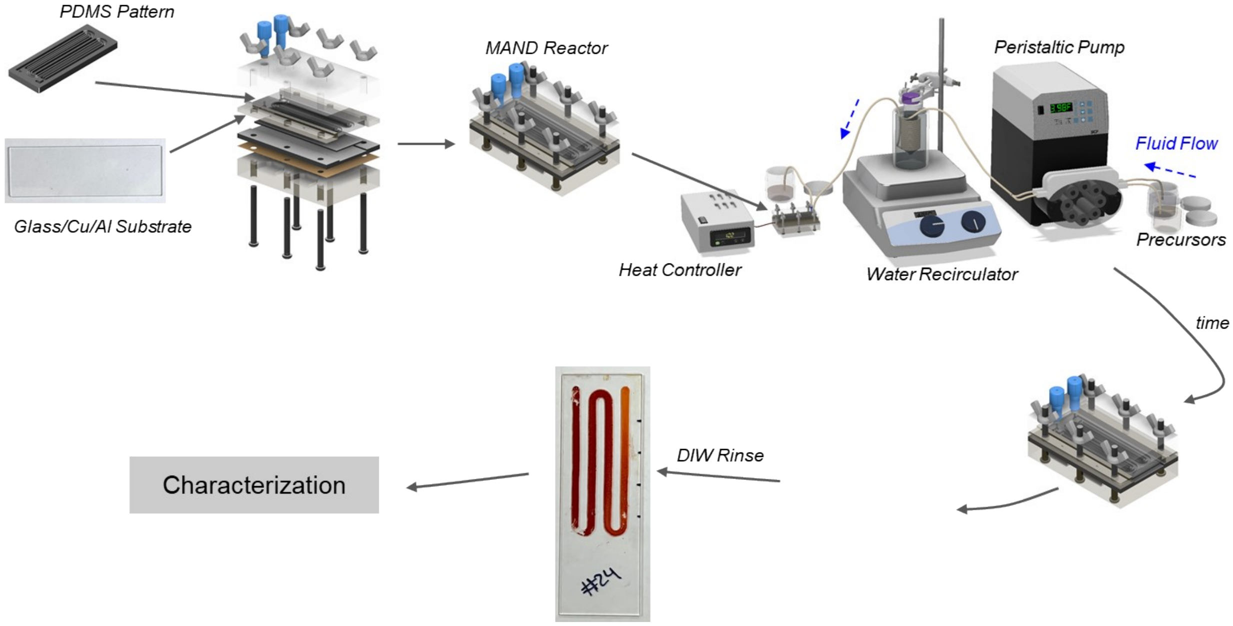


Fig S. 2 Schematics of the MASL fabrication process.

Fig S 3 shows the COMSOL predicted thermodynamic properties of the water bath on the solution as a function of bath temperature, Tbath (°C), and flow rate, Q (mL/min). This information was used to design the bath tube length and bath temperature to achieve a target outlet temperature of the reaction solution, given a known flow rate. Similarly, the outlet temperature from a water bath can be predicted based on a known tubing length, bath temperature, and flow rate. All the simulations assumed laminar flow based on the Reynolds number equation, as shown in Equation S2. The equations are defined such that w is the width of the channel, h is the height of the channel, ρ is the fluid density, V is the fluid velocity, D is the hydraulic diameter, and μ is the fluid dynamic viscosity. A table of all the different pattern dimensions and resulting values is presented in Table S1.

$$D = \frac{4wh}{2w + 2h} \tag{S1}$$

$$R_e = \frac{\rho V D}{\mu} \tag{S2}$$

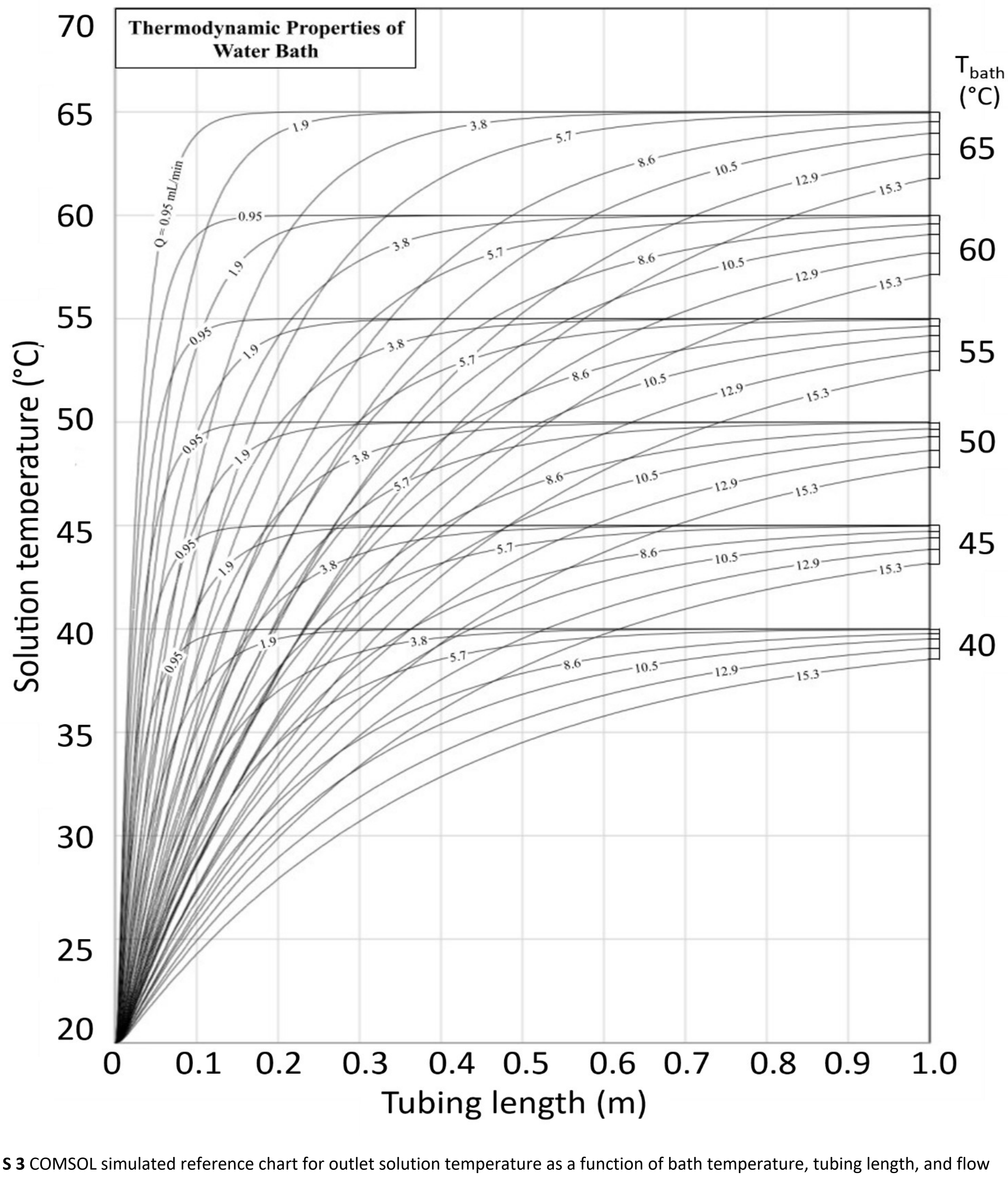


Fig S 3 COMSOL simulated reference chart for outlet solution temperature as a function of bath temperature, tubing length, and flow rate.

Table S 1. Reynolds number calculations for all pattern dimensions

Pat. ID	w (mm)	h (mm)	Density (g/mm³)	Velocity (mm/s)	D (mm)	μ (g/mm-s)	R_e
Growth	2.5	1	0.000786	30	1.429	0.002381	14.148
Growth	2.5	1	0.000786	80	1.429	0.002381	37.727
Optical	2.5	0.75	0.000786	30	1.154	0.002381	11.427
Optical	2.5	0.75	0.000786	80	1.154	0.002381	30.472
Optical	1	0.4	0.000786	30	0.571	0.002381	5.659
Optical	1	0.4	0.000786	80	0.571	0.002381	15.091
Optical	13	0.5	0.000786	30	0.963	0.002381	9.537
Optical	13	0.5	0.000786	80	0.963	0.002381	25.431
Coin	2.5	0.5	0.000786	30	0.833	0.002381	8.253
Coin	2.5	0.5	0.000786	80	0.833	0.002381	22.008
Coin	10	0.5	0.000786	30	0.952	0.002381	9.432
Coin	10	0.5	0.000786	80	0.952	0.002381	25.151

Crystal Structure

The XRD results in Fig S. 4 are from a copper foil substrate sample at a temperature of 80 °C, flow rate of 2.5mL/min, and deposition time of 15 minutes. The sample was annealed at 300 °C for 60 min in the atmosphere. The annealed samples show intensity peaks that overlap with the expected hkl planes for orthorhombic Sb_2S_3, CuS, and respective oxides.

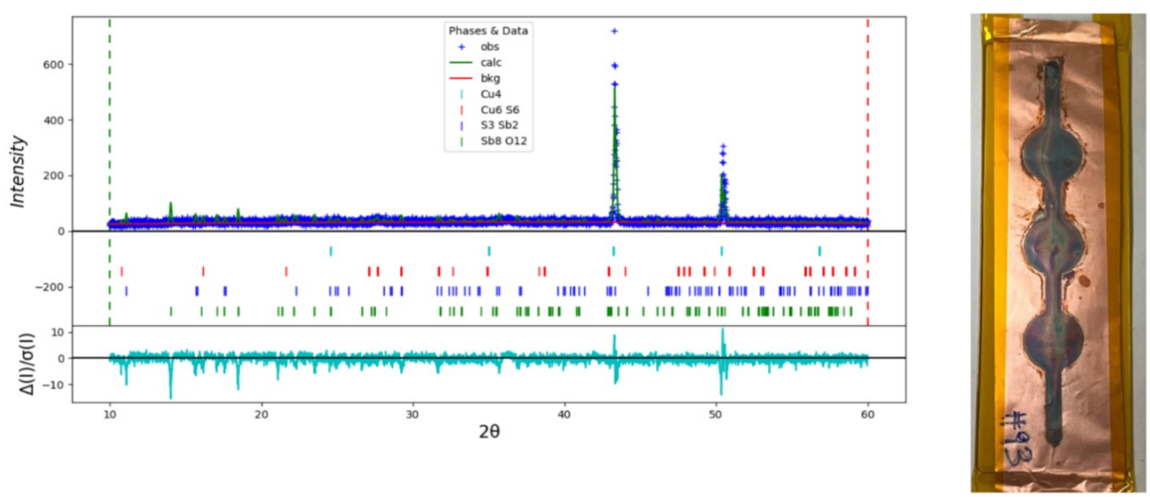


Fig S 4. XRD scan of annealed Sb_2S_3 thin films at 300 °C for 60min on Cu substrate.

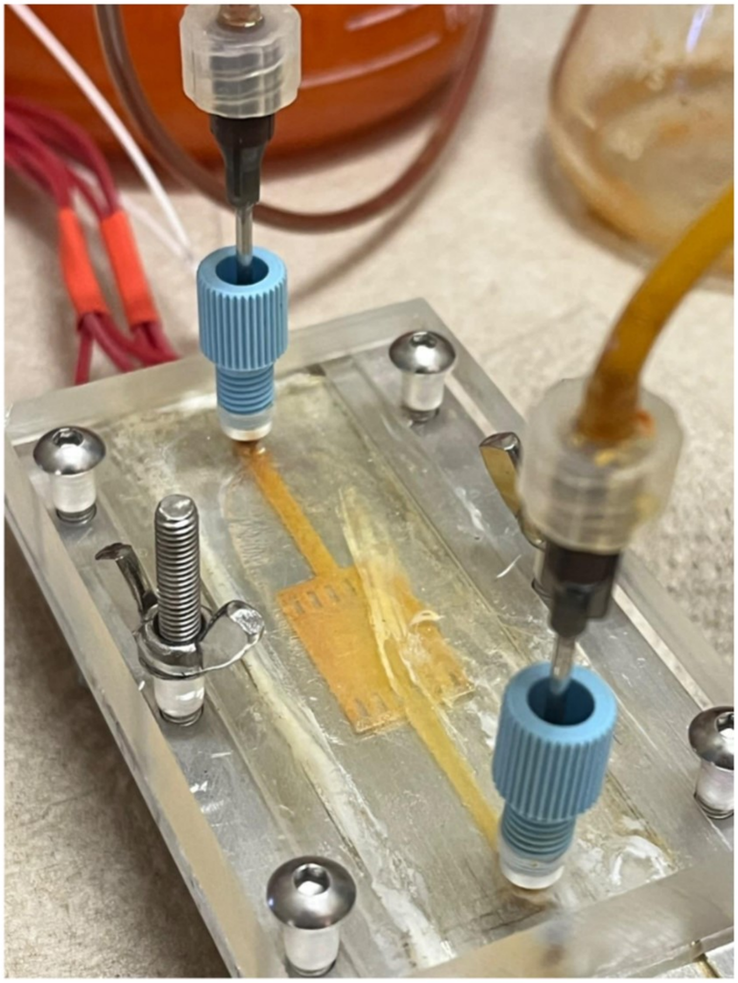
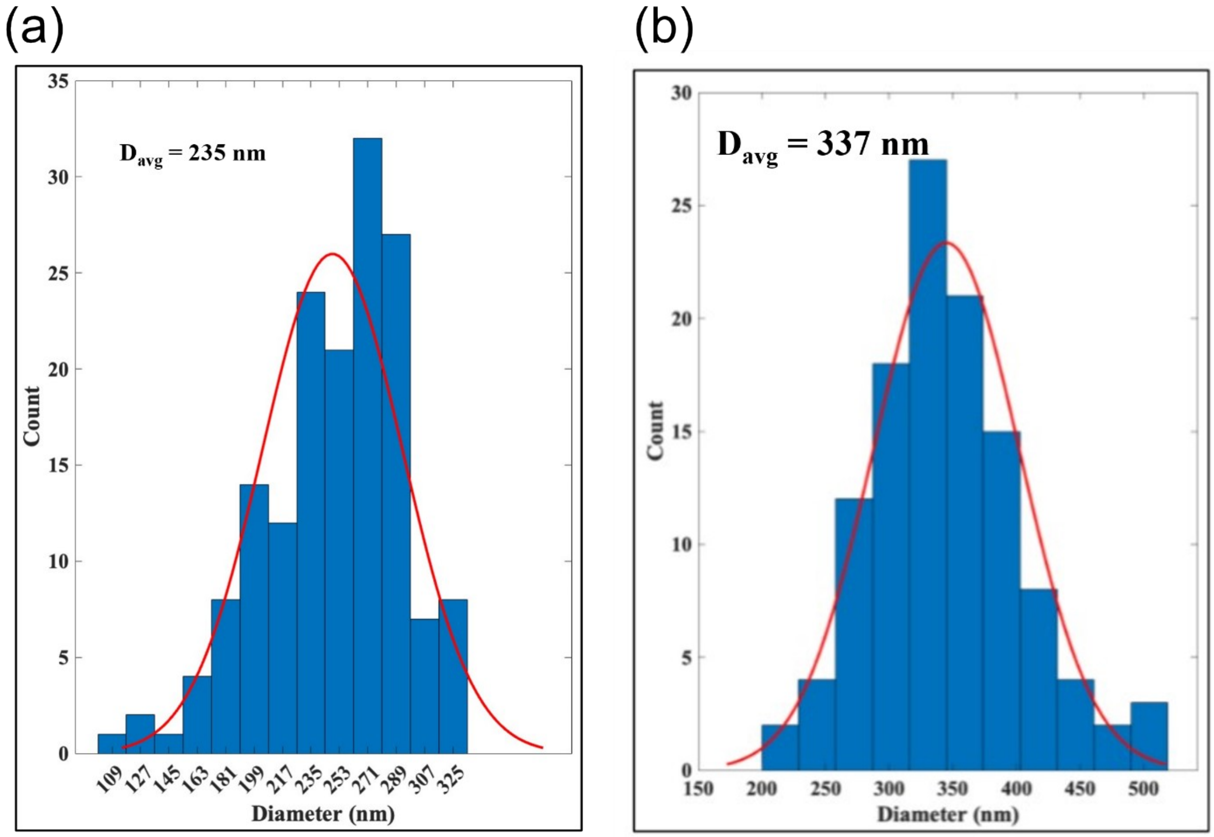


Fig S 5. Optical properties samples. view of MAND reactor creating optical sample (left), example sample of optical pattern (right)



Element	Wt%	At%
SK	34.63	66.79
SbL	65.37	33.21

Element	Wt%	At%
SK	44.36	75.17
SbL	55.64	24.83

Fig S 6 Particle size distribution a) on Al current collector, b) on Cu current collector