

## Supplementary Information

### **Effect of Morphological Variation in Three-Dimensional Multiwall Carbon Nanotubes as Host Cathode Material for High-Performance Rechargeable Lithium-Sulfur Batteries**

Pashupati R. Adhikari<sup>a</sup>, Eunji Lee<sup>c</sup>, Lee Smith<sup>a</sup>, Jeongyong Kim<sup>c</sup>, Sheldon Shi<sup>a</sup>, Wonbong Choi<sup>a, b, \*</sup>

<sup>a</sup>Department of Mechanical Engineering, University of North Texas, Denton, TX 76207, USA

<sup>b</sup>Department of Material Science and Engineering, University of North Texas, Denton, TX 76207, USA

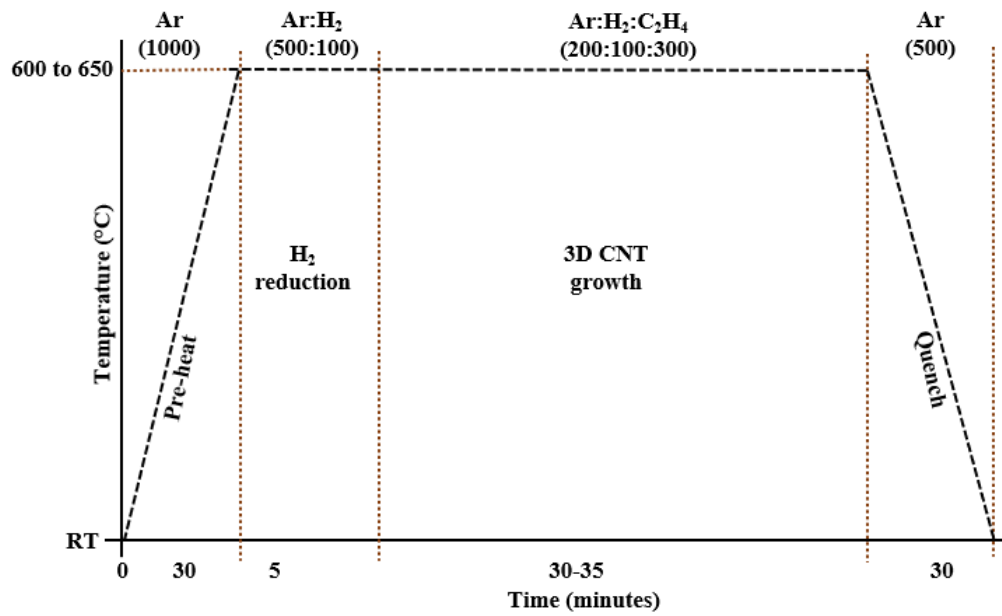
<sup>c</sup>Department of Energy Science, Sungkyunkwan University, Suwon 16419, Republic of Korea

\* Corresponding Author: Department of Mechanical Engineering, University of North Texas, Discovery Park, 3940 North Elm St., Denton, TX 76207, USA.

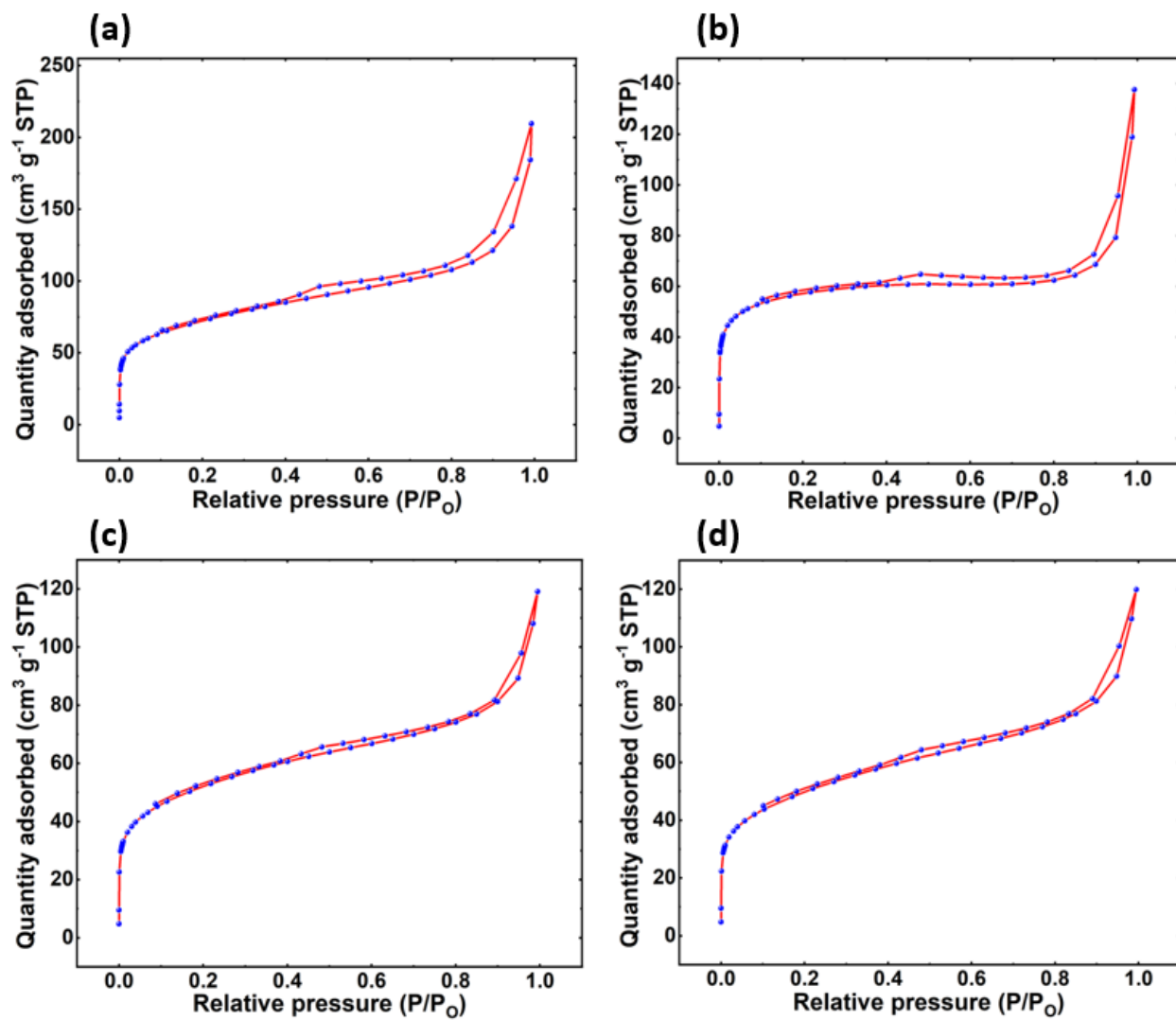
E-mail: [wonbong.choi@unt.edu](mailto:wonbong.choi@unt.edu)

**Table S1.** The deposition rate and total thicknesses of Titanium (Ti) and Nickel (Ni) on Cu-mesh used for 3D CNTs synthesis.

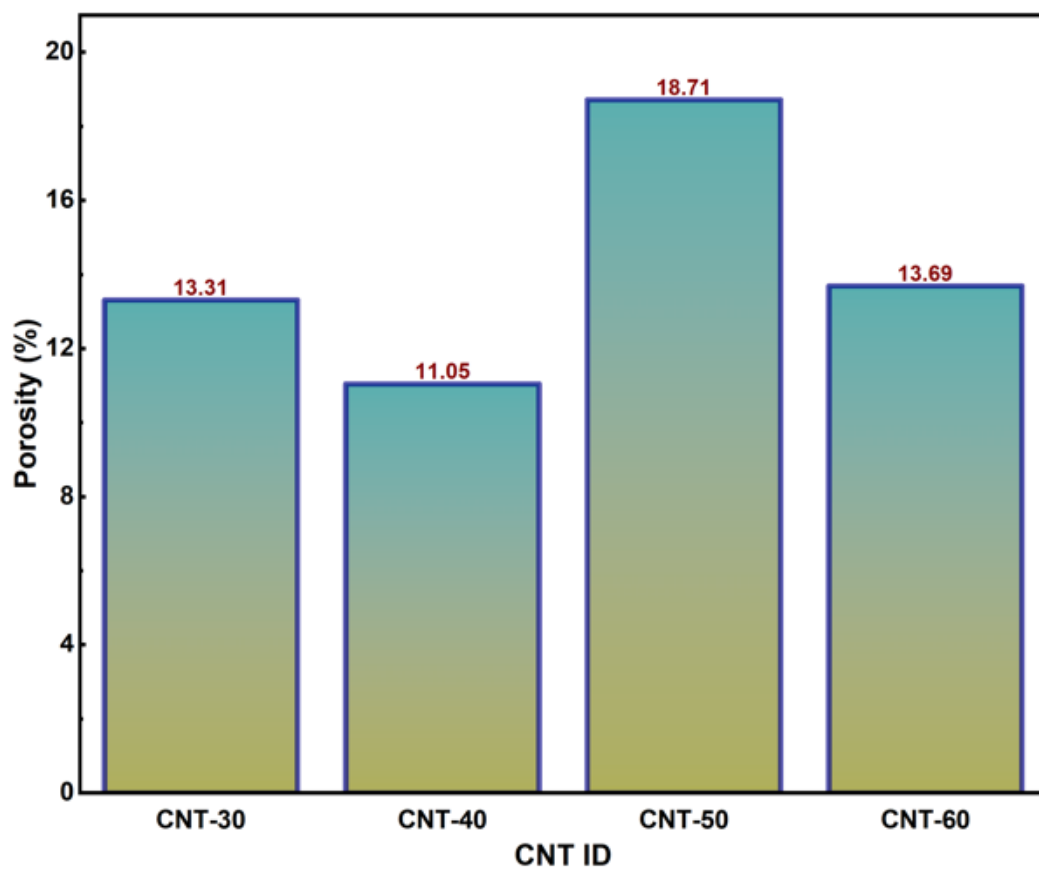
Ti-time (min)	Ni-time (min)	Ti-deposition rate (nm/min)	Ni-deposition rate (nm/min)	Ti-thickness (nm)	Ni-thickness (nm)
8	6	3.75	5	30	30
8	8	3.75	5	30	40
8	10	3.75	5	30	50
8	12	3.75	5	30	60



**Figure S1.** A schematic showing the steps involved in the complete 3D CNTs synthesis process.



**Figure S2.** Nitrogen adsorption-desorption BET isotherms of (a) CNT-30, (b) CNT-40, (c) CNT-50, and (d) CNT-60 3D CNTs.



**Figure S3.** Porosities (%) of all four 3D CNTs obtained using t-plot analysis.

**Table S2.** BJH pore size distribution of all four 3D CNTs

<b>CNT ID</b>	<b>Adsorption (<math>\text{cm}^3 \text{g}^{-1} \text{nm}^{-1}</math>)</b>	<b>Desorption (<math>\text{cm}^3 \text{g}^{-1} \text{nm}^{-1}</math>)</b>
<b>CNT-30</b>	0.1595	0.1481
<b>CNT-40</b>	0.1413	0.1148
<b>CNT-50</b>	0.0848	0.0767
<b>CNT-60</b>	0.0897	0.0804

**Table S3.** Calculated diffusion coefficients of lithium-ions for CNT-S-50 based on CV analyses.

<b>Reaction Type</b>	<b>Slope</b>	<b>Diffusion coefficient (cm<sup>2</sup> s<sup>-1</sup>)</b>
Cathodic (C <sub>1</sub> ): S <sub>8</sub> -Li <sub>2</sub> S <sub>4</sub>	0.2577	4.60 x 10 <sup>-09</sup>
Cathodic (C <sub>2</sub> ): Li <sub>2</sub> S <sub>4</sub> -Li <sub>2</sub> S	0.4884	1.65 x 10 <sup>-08</sup>
Anodic (A <sub>1</sub> ): Li <sub>2</sub> S-S <sub>8</sub>	0.5195	1.87 x 10 <sup>-08</sup>