

Supporting Information

### **3D Printed Carbon Nanotube/ Phenolic Composites for Thermal Dissipation and Electromagnetic Interference Shielding**

*Thang Q. Tran, <sup>†,§</sup> Sayyam Deshpande, <sup>†</sup> Smita Shivraj Dasari, <sup>†</sup> Kailash Arole, <sup>‡</sup> Denis Johnson, <sup>†</sup> Yufan Zhang, <sup>†</sup> Ethan M. Harkin, <sup>†</sup> Abdoulaye Djire, <sup>†,‡</sup> Hang Li Seet, <sup>§</sup> Sharon Mui Ling Nai, <sup>§</sup> Micah J. Green <sup>\*, †, ‡</sup>*

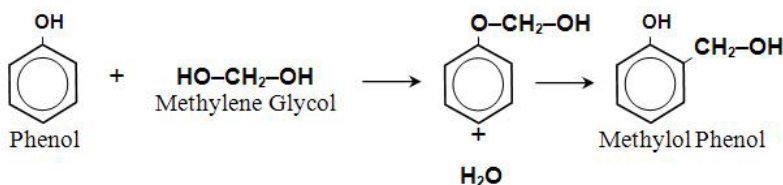
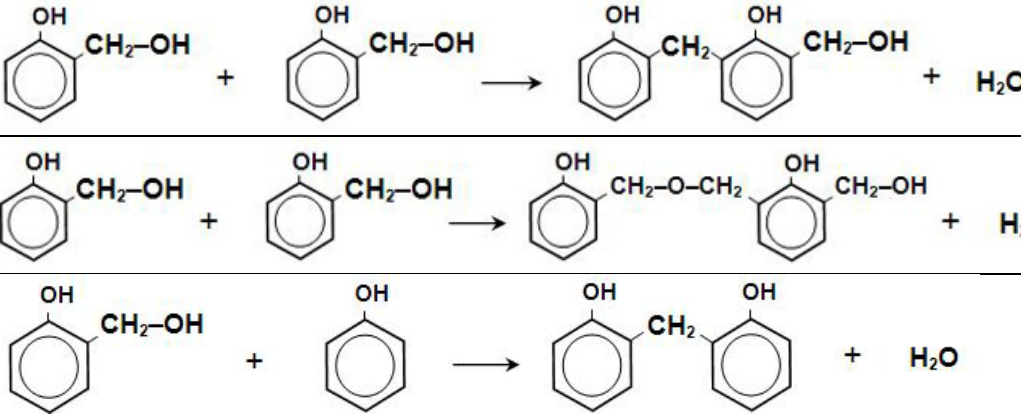
<sup>†</sup> Artie McFerrin Department of Chemical Engineering, Texas A&M University, College Station, TX, 77843, USA

<sup>§</sup> Singapore Institute of Manufacturing Technology (SIMTech), Agency for Science, Technology and Research (A\*STAR), 5 Cleantech Loop, #01-01 Cleantech Two Block B, Singapore 636732, Republic of Singapore

<sup>‡</sup> Department of Materials Science and Engineering, Texas A&M University, College Station, TX, 77843, USA

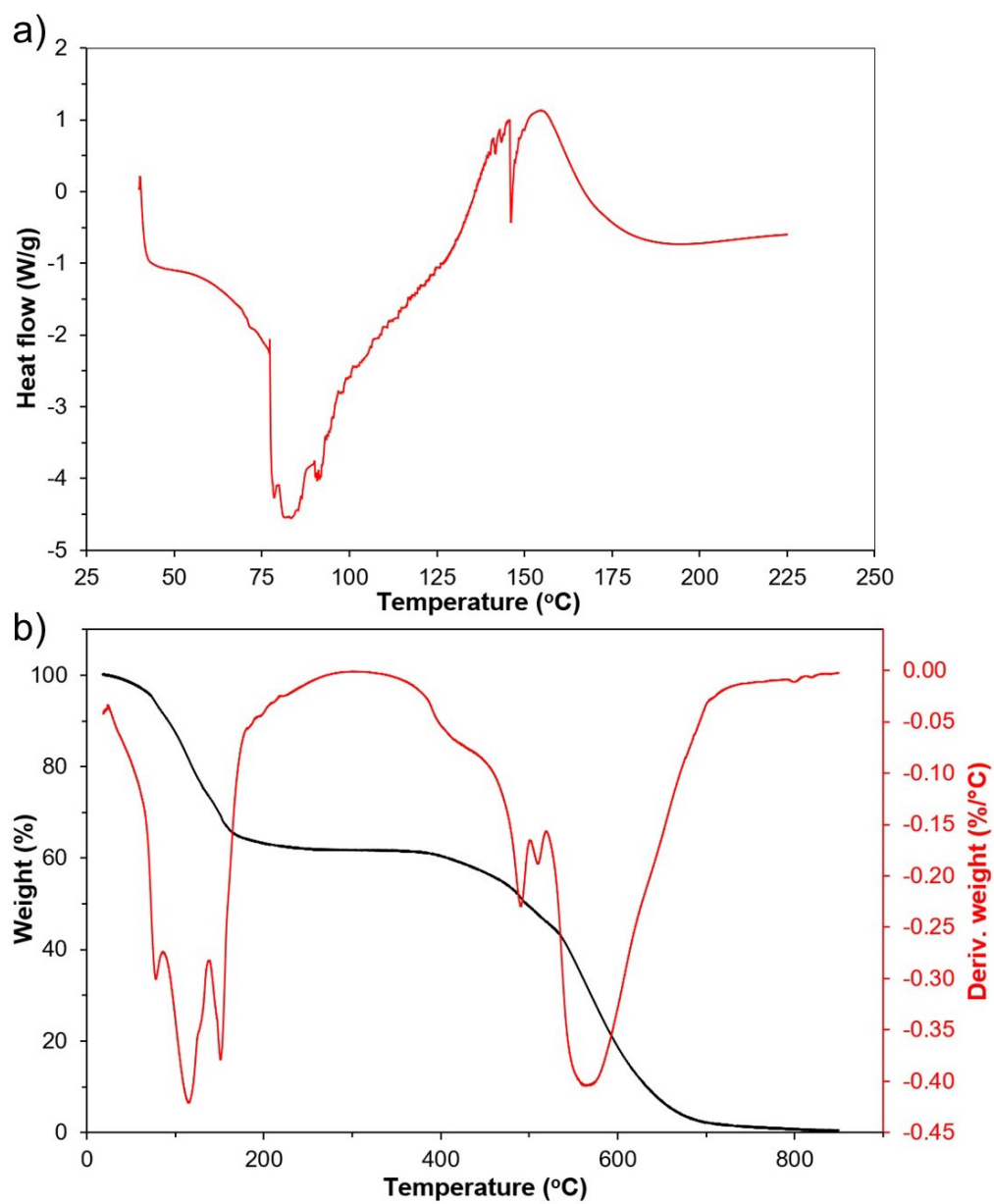
\*Corresponding author: E-mail: [micah.green@tamu.edu](mailto:micah.green@tamu.edu) (Micah J. Green)

**Table S1.** Different stages of cross-linking reactions of PLENCO 14670

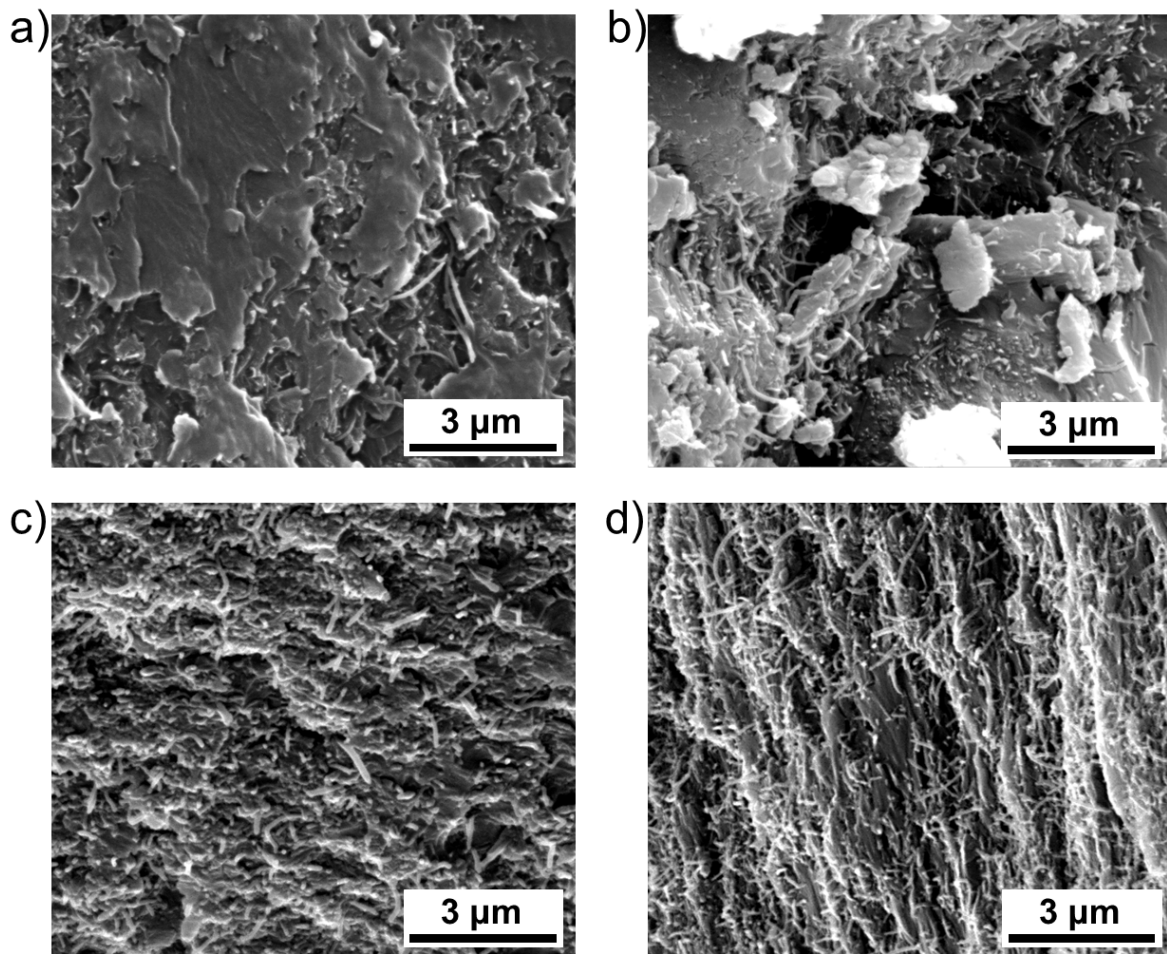
| Stage No. | Chemical reaction                                                                                                                                                                                                                                                               |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         |  <p>Phenol + HO-CH<sub>2</sub>-OH (Methylene Glycol) → Intermediate + H<sub>2</sub>O → Methylol Phenol</p>                                                                                    |
| 2         |  <p>Methylol Phenol + Methylol Phenol → Dimer + H<sub>2</sub>O</p> <p>Methylol Phenol + Methylol Phenol → Dimer + H<sub>2</sub>O</p> <p>Methylol Phenol + Phenol → Dimer + H<sub>2</sub>O</p> |

**Table S2.** Slow curing cycle of CNT/phenolic composites

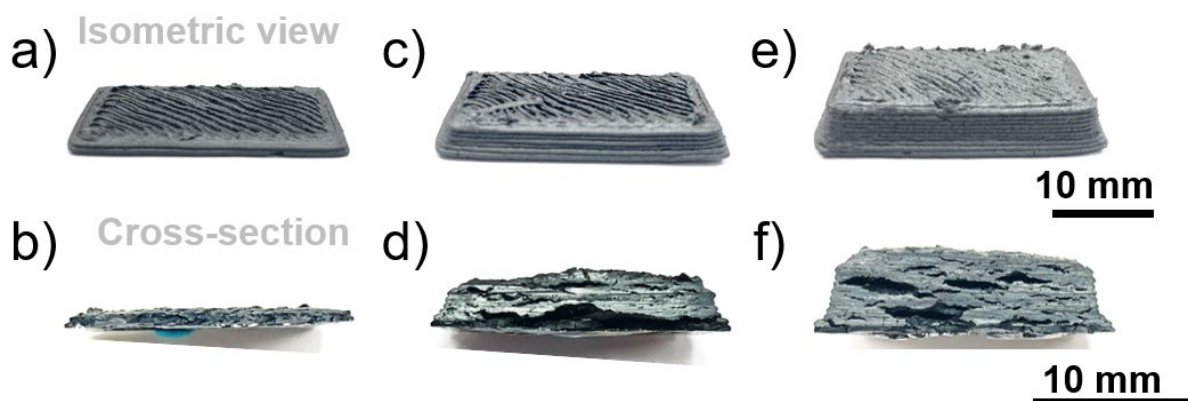
|                  |    |    |    |    |     |     |     |
|------------------|----|----|----|----|-----|-----|-----|
| Temperature (°C) | 60 | 70 | 80 | 90 | 100 | 120 | 150 |
| Hold time (h)    | 12 | 4  | 4  | 4  | 12  | 6   | 6   |



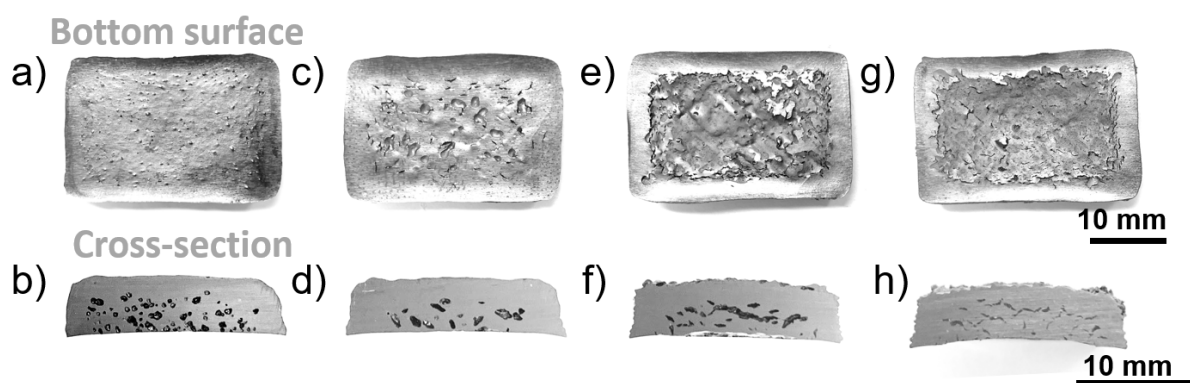
**Figure S1.** a) TGA and b) DSC results for neat phenolic resin



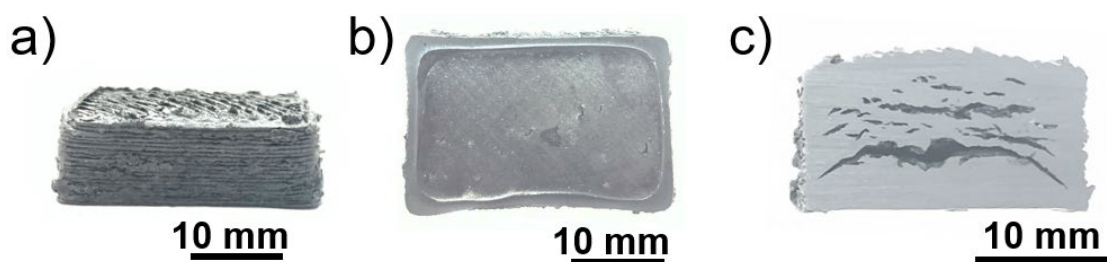
**Figure S2.** Cryo-fracture surface of printed CNT/phenolic with CNT loading of a) 4 wt.%; b) 6 wt.%, c) 8 wt.%, and d) 10 wt.%



**Figure S3.** Isometric view and cross-section of 10% CNT/phenolic samples printed on Al substrates and cured by the fast cycle. (a, b) 1-mm-thick samples, (c, d) 3-mm-thick samples, and (e, f) 5-mm-thick samples.



**Figure S4.** Bottom surface and cross-section of 5-mm-thick CNT/phenolic samples printed on Al substrates and cured by the slow cycle. (a, b) 4% CNT/phenolic, (c, d) 6% CNT/phenolic, (e, f) 8% CNT/phenolic, (g, h) 10% CNT/phenolic.



**Figure S5.** a) Isometric view, b) bottom surface, and c) cross-section of 5-mm-thick 10% CNT/phenolic samples printed on paper substrates and cured by the slow cycle.