# Supporting Information

# Preparation of Sub-Micron High-Performance Polyetherimide Particles for Fabricating Carbon Fiber Reinforced Polymer Composites

Rui Zhang,[§1] Jacob J. Fallon,[§2,3] Ronald M. Joseph,[1,3] Jessica A. Thomas,[1,3] Maryam S. Hassan,[1] Shreya Roy Choudhury,[1,3] Eric L. Gilmer,[2,3] Munetaka Kubota,[4] Joseph M. Deitzel,[4] Judy S. Riffle,[1,3] Michael J. Bortner,[*2,3]

[1]Department of Chemistry,

[2]Department of Chemical Engineering,

and [3]Macromolecules Innovation Institute, Virginia Tech, Blacksburg, VA, 24061, USA

[4]Center for Composite Materials, Univeristy of Delaware, Newark, DE 19716 USA

[§] denotes co-first author

*Corresponding author, Email: mbortner@vt.edu

*Synthesis of Bis(4,4'-m-aminophenoxy)-3,3'-disulfonate diphenylsulfone monomer (1): m-*Aminophenol (*m*-AP, 10 g, 0.092 mol), distilled NMP (90 mL), $K_2CO_3$ (16.46 g, 0.119 mol), and dry toluene (41 mL) were added to a 250-mL, 3-neck round bottom flask equipped with a mechanical stirrer, Dean-Stark trap, condenser, and $N_2$ inlet. The mixture was stirred for 4-5 h at 145 °C to azeotrope water. The trap was drained and the excess toluene was removed. SDCDPS (15 g, 0.0305 mol) and distilled NMP (35 mL) were added to the reaction flask. The temperature was increased to 170 °C and the solution was stirred for 24 h. The solution was filtered hot to remove the $K_2CO_3$ and then precipitated in ethyl acetate. A light brown precipitate formed that was stirred in ethyl acetate overnight. The product was dried under vacuum at 120 °C overnight. >95% yield. 100% disulfonated material was obtained.

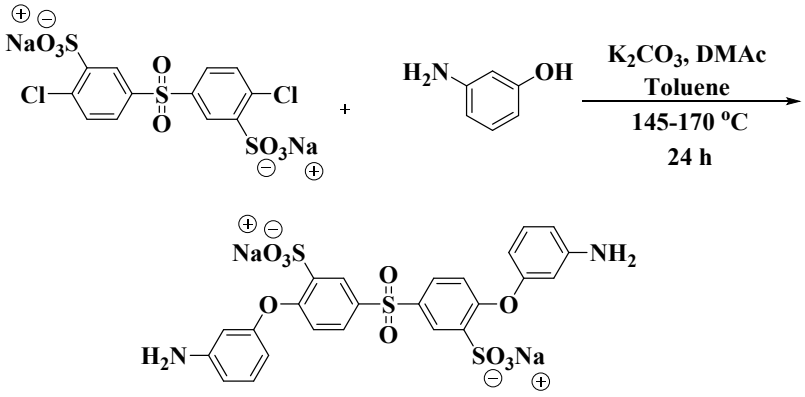


**Figure S1** Synthesis of the disulfonated diamine monomer (1) for the sPISalt suspending agent.

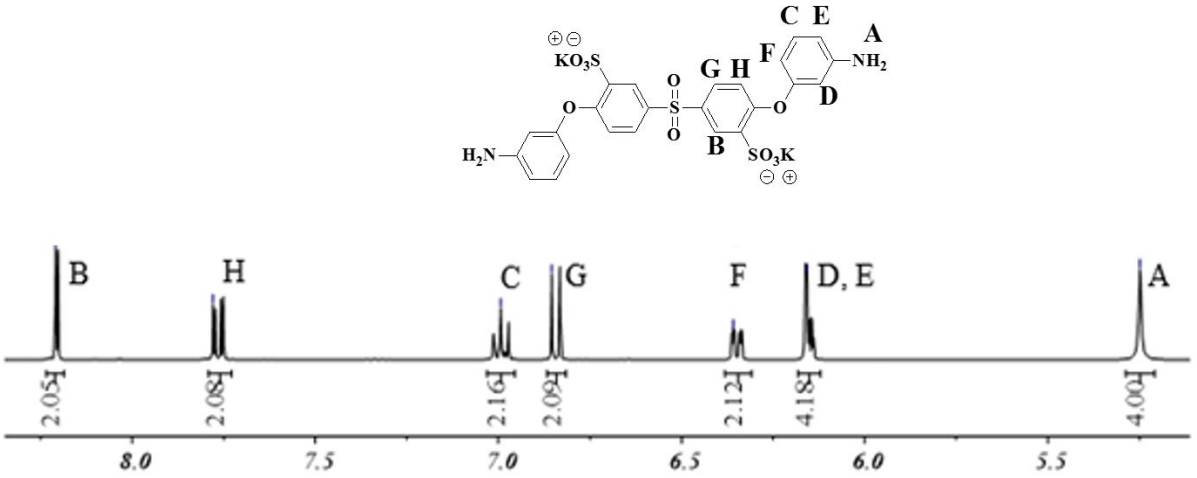


**Figure S2** [1]H NMR of the disulfonated monomer (1). The aromatic amine peak, labeled A (5.25 ppm), was used as a reference set at 4.00. The peak labeled B (8.21 ppm) corresponds to the aromatic proton adjacent to the sulfonate group. Quantitative substitution to form the monomer was obtained as shown by the peak labeled B integrating to 2.

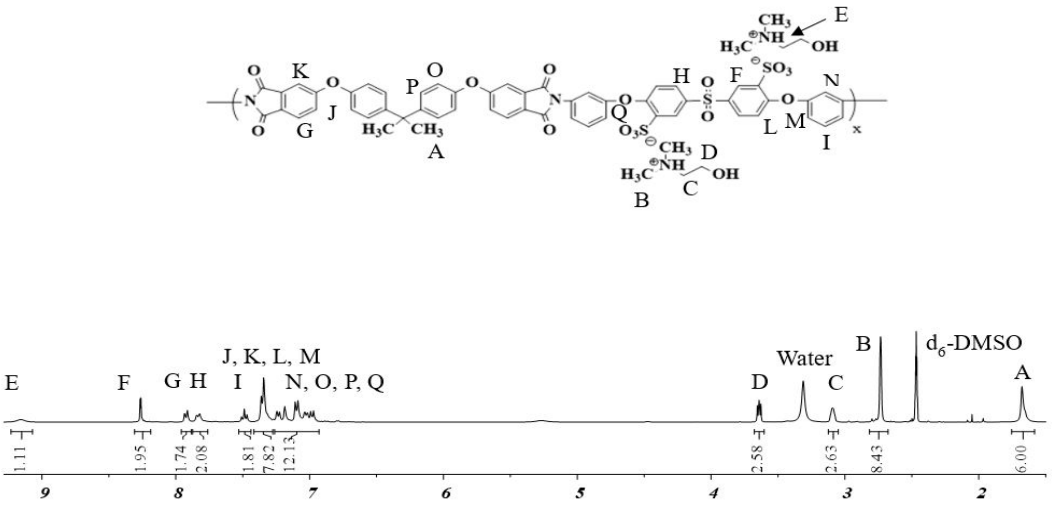


**Figure S3** [1]H NMR of s-PISalt with a dimethylethanolammonium counterion. The isopropylidene protons (1.68 ppm) were used as a reference with the integral set to 6. The degree of disulfonation was calculated using the integral of the peaks corresponding to the proton adjacent to the sulfonate group (8.26 ppm) divided by 2.

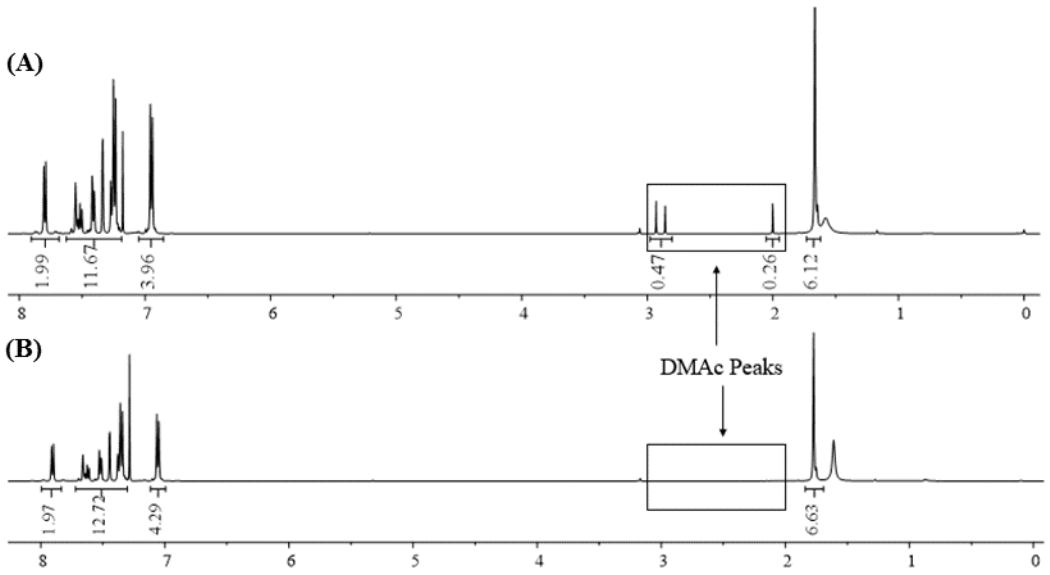


**Figure S4** $^{1}$H NMR of the fabricated PEI particles using nucleation and growth method and dried by different methods. (A: Dried by lyophilization at low temperature; B: Dried under vacuum at 140 °C)

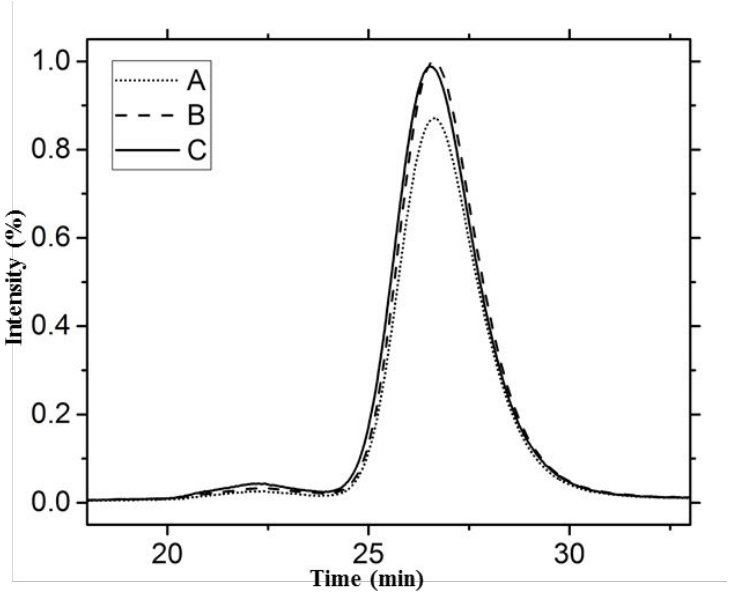


**Figure S5** SEC light scattering curves from A) the PEI starting material, and B and C) Two batches of PEI after being fabricated into particles by the nucleation and growth method and re-dissolved.

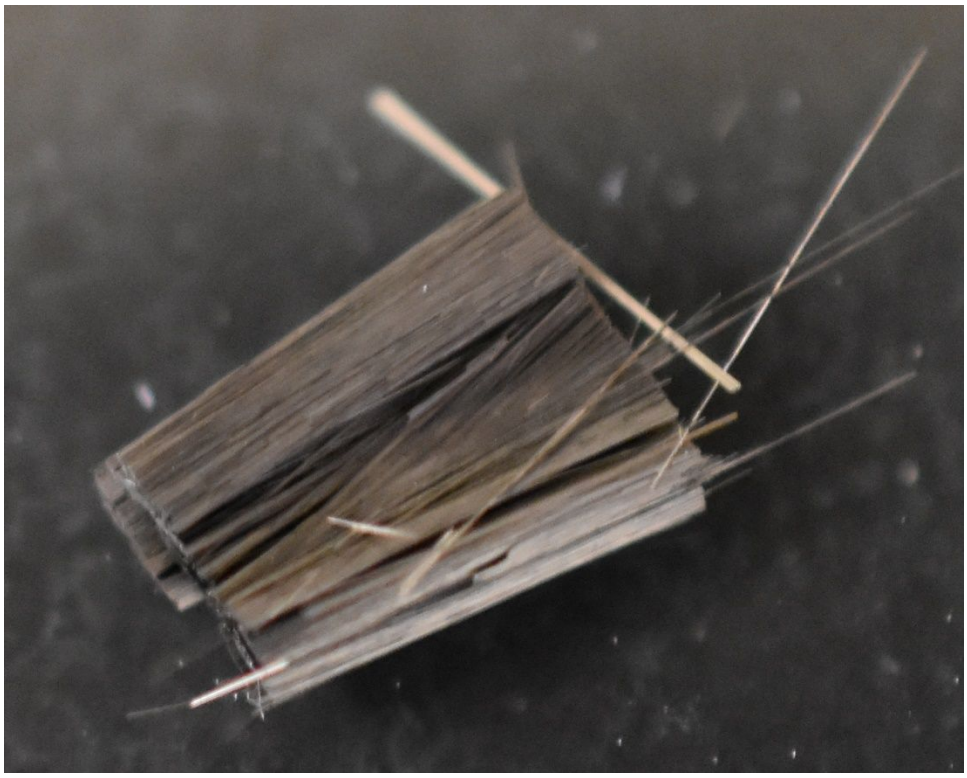

**Figure S6** Camera image of tightly packed carbon fiber bundle, which has a significant degree of surface contact with neighboring fibers, potentially limiting the degree of surface treatment.