

## Supporting Materials

# Highly Proton-Conducting Membranes Based on Poly(Arylene Ether)s with Densely Sulfonated and Partially Fluorinated Multiphenyl for Fuel Cell Applications

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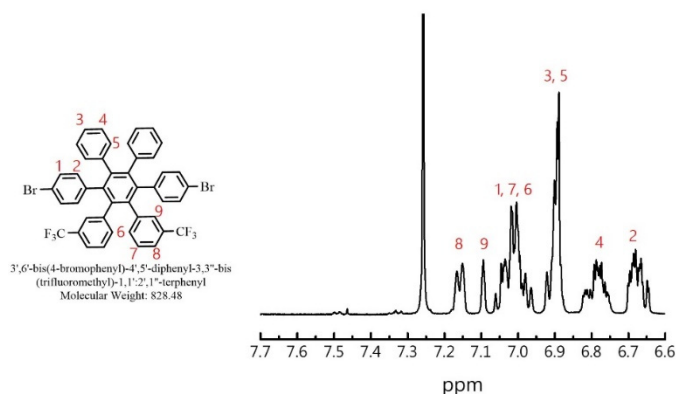
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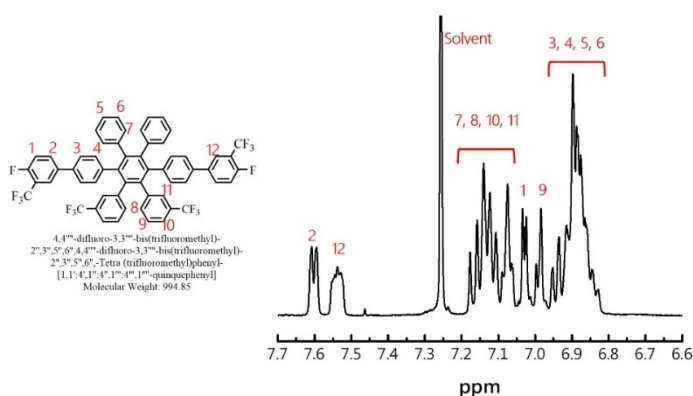
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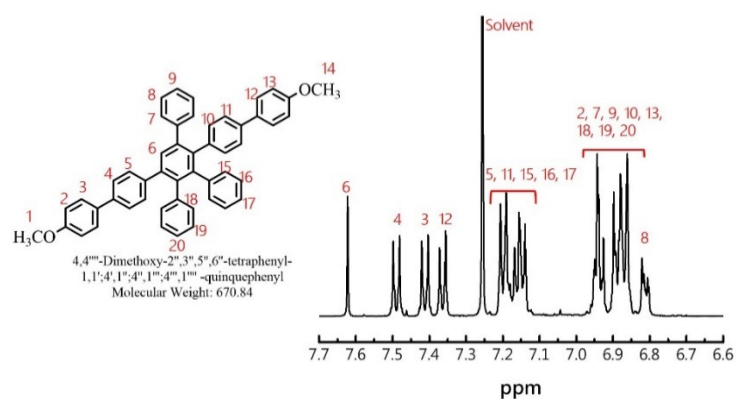
We also measured the FTIR, <sup>1</sup>H NMR and MALDI-TOF of this series compounds, shown in Figure S1 to Figure S16.



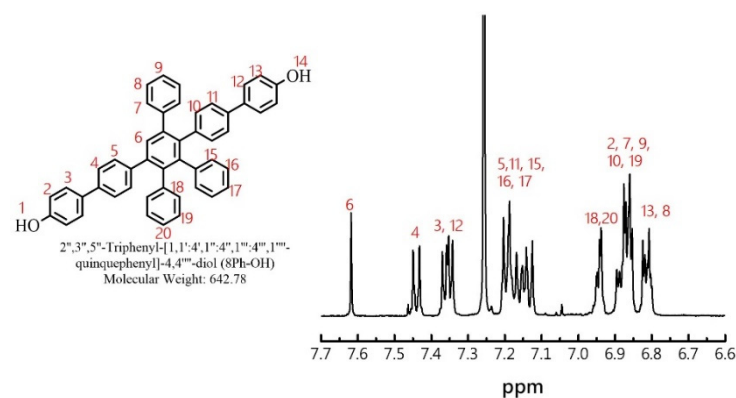
**Figure S1.** <sup>1</sup>H NMR spectrum of 3',6'-bis(4-bromophenyl)-4',5'-diphenyl-3,3''-bis(trifluoromethyl)-1,1':2',1''-terphenyl (1) (6F7B-DB).



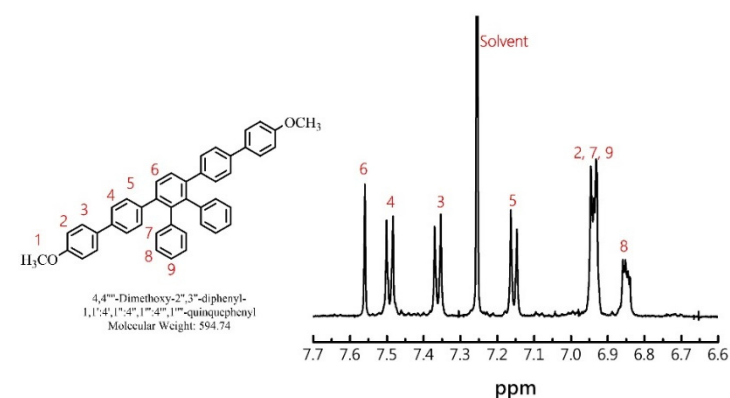
**Figure S2.** <sup>1</sup>H NMR spectrum of 4,4''-difluoro-3,3''-bis(trifluoromethyl)-2',3',5'',6''-4,4''-difluoro-3,3''-bis(trifluoromethyl)-2'',3'',5',6',-Tetra(trifluoromethyl)phenyl-[1,1':4'',1''':4''',1''':4''',1''':4'''-quinquephenyl] (2) (12F9B-DF).



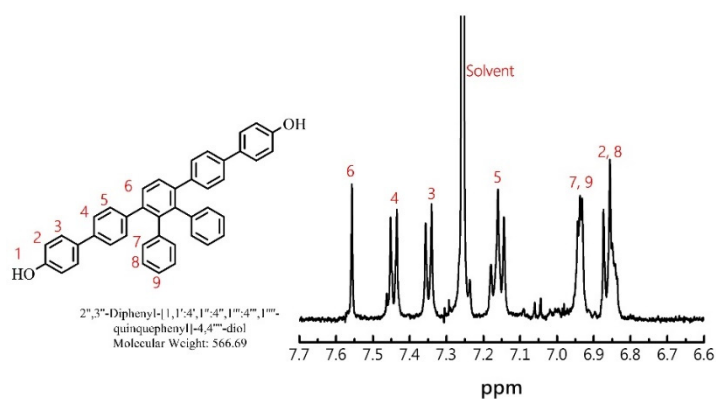
**Figure S3.**  $^1\text{H}$  NMR spectrum of 4,4''-Dimethoxy-2'',3'',5''-triphenyl-1,1':4',1'':4'',1'''-quinquephenyl (3) (8B-DMO).



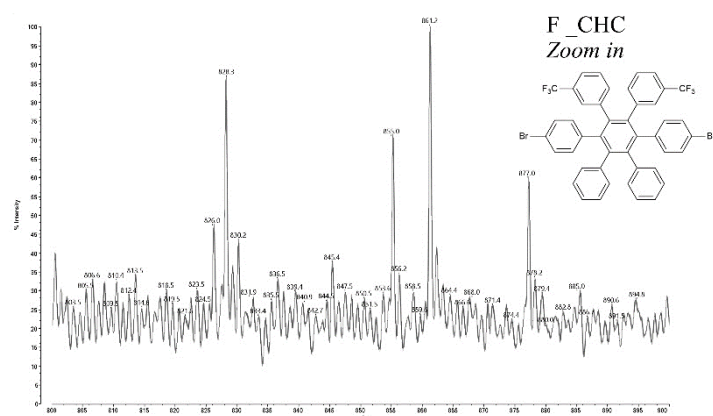
**Figure S4.**  $^1\text{H}$  NMR spectrum of 2'',3'',5''-Triphenyl-[1,1':4',1'':4'',1'''-quinquephenyl]-4,4''-diol (4) (8B-DO).



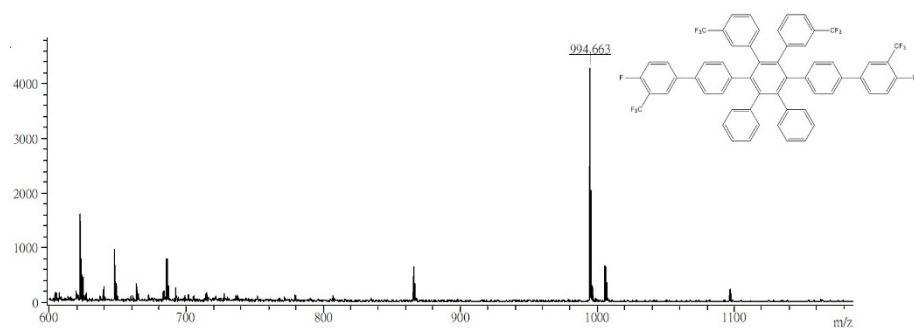
**Figure S5.**  $^1\text{H}$  NMR spectrum of 4,4''-Dimethoxy-2'',3''-diphenyl-1,1':4',1'':4'',1'''-quinquephenyl (5)(7B-DMO).



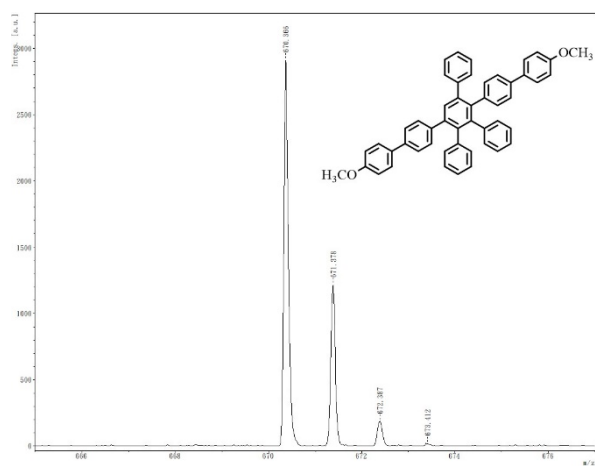
**Figure S6.**  $^1\text{H}$  NMR spectrum of 2'',3''-Diphenyl-[1,1':4',1'':4'',1''':4''',1''''-quinquephenyl]-4,4''''-diol (6) (7B-DO).



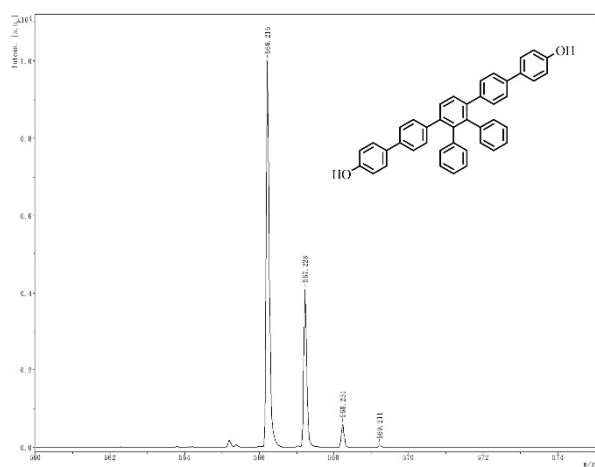
**Figure S7.** MALDI-TOF spectrum of 6F7B-DB.



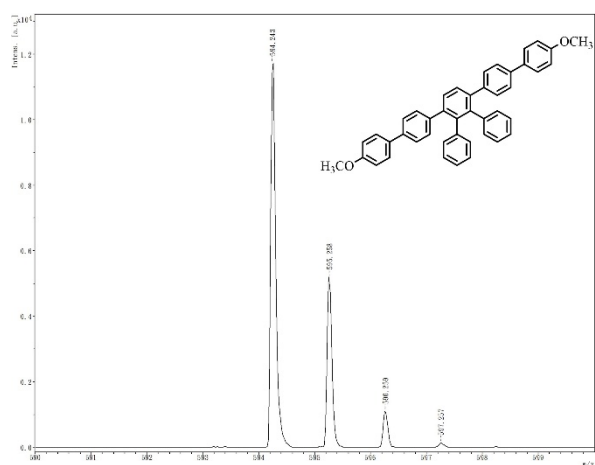
**Figure S8.** MALDI-TOF spectrum of 12F9B-DF.



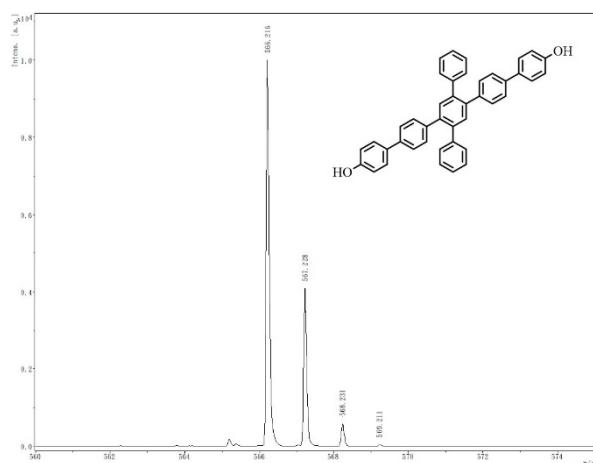
**Figure S9.** MALDI-TOF spectrum of 8B-DMO.



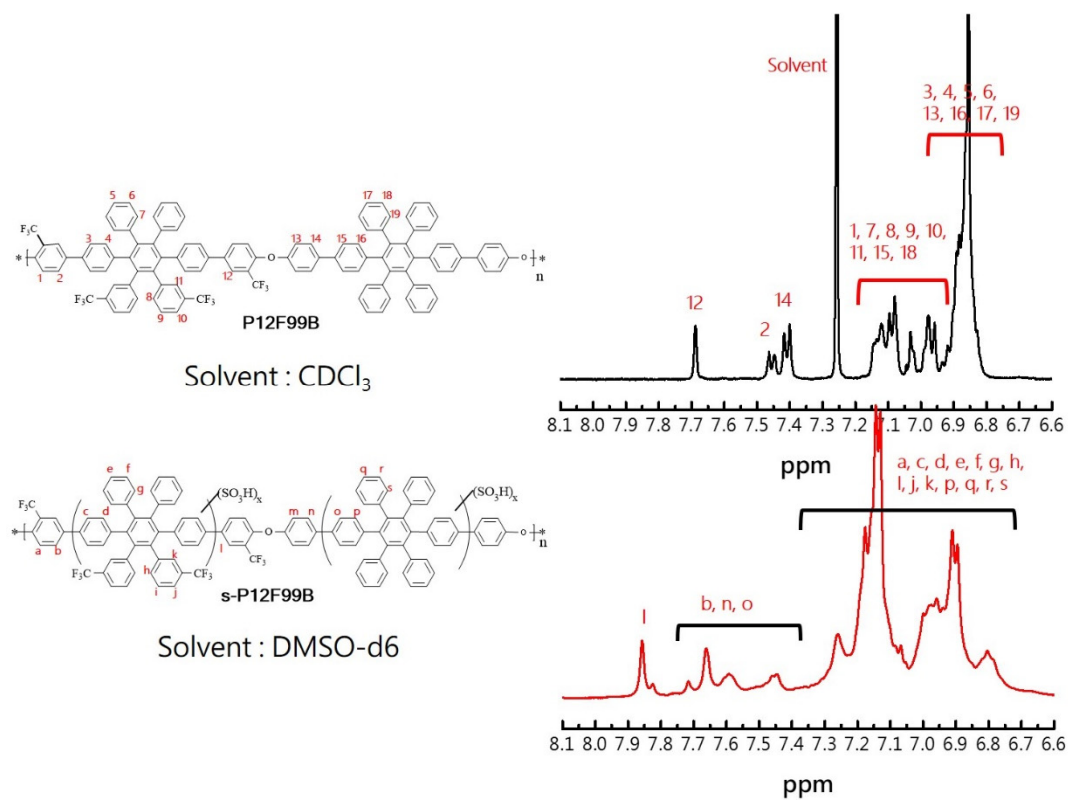
**Figure S10.** MALDI-TOF spectrum of 8B-DO.



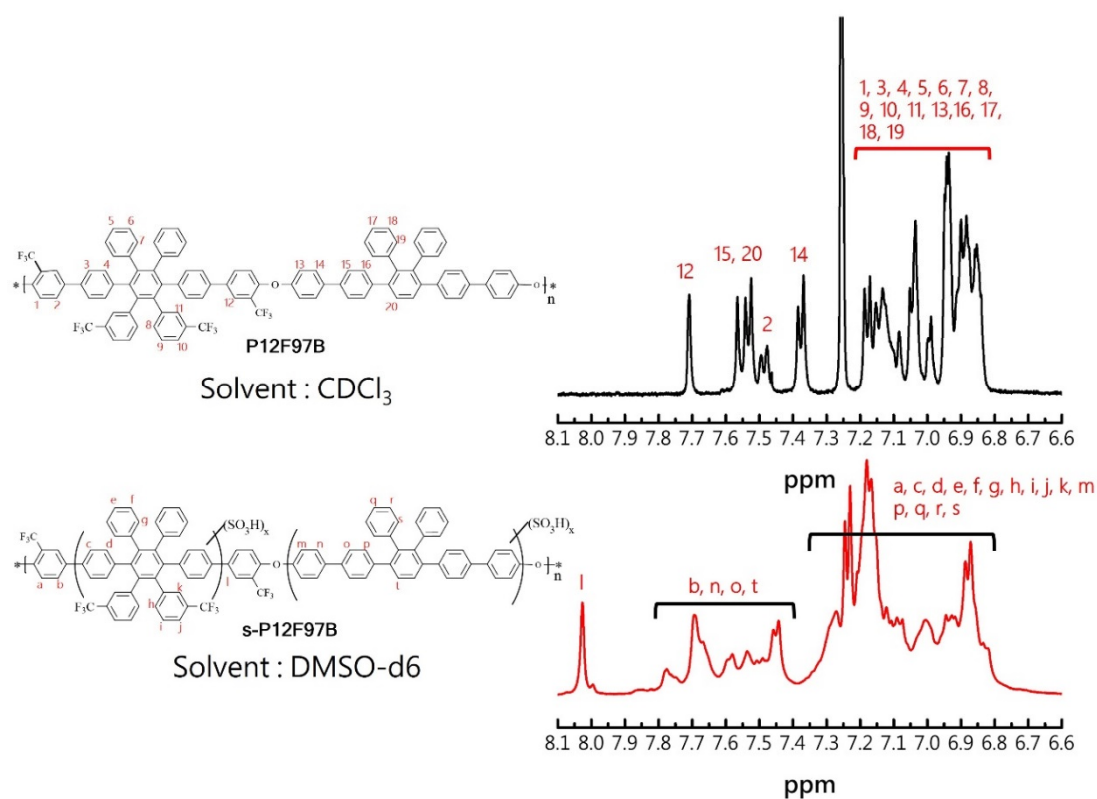
**Figure S11.** MALDI-TOF spectrum of 7B-DMO.



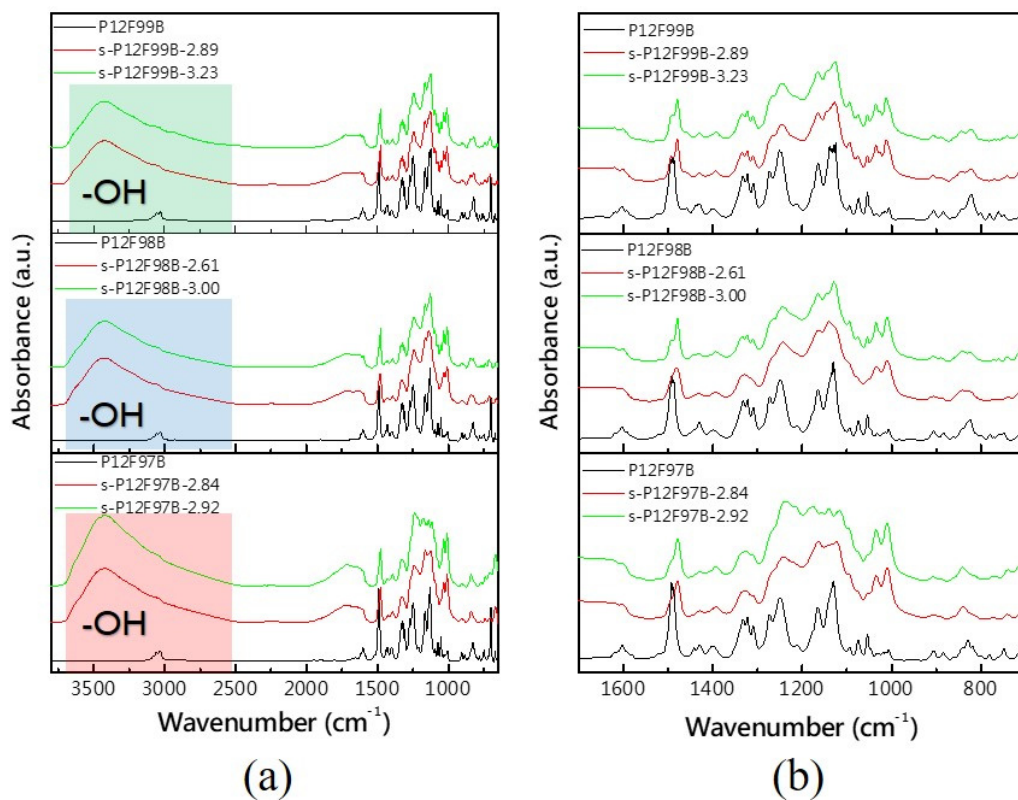
**Figure S12.** MALDI-TOF spectrum of 7B-DO.



**Figure S13.**  $^1\text{H}$  NMR spectrum of P12F99B (top) and s-P12F99B (bottom).



**Figure S14.**  $^1\text{H}$  NMR spectrum of P12F97B (top) and s-P12F97B (bottom).



**Figure S15.** FTIR spectra of the P12FmB polymers and after sulfonation from (a) 650 to 3800  $\text{cm}^{-1}$  and (b) 700 to 1700  $\text{cm}^{-1}$ .