Supplementary Material (ESI) for Journal of Materials Chemistry

Supporting Information

Highly Selective Proton Conductive Networks based on Chain-end Functionalized Polymers with Perfluorosulfonate Side Groups

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Characterization. ^{1}H and ^{19}F NMR spectra were recorded on a Bruker AM-300 spectrometer instrument with tetramethylsilane as internal reference. Gel permeation chromatography (GPC) measurements were performed on a Viscotek Model 302 triple detector system equipped with refractive index, light scattering and viscometer detectors. DMF containing 0.02 M LiBr was used as the eluent at a flow rate 1.0 mL/min, and the column temperature was set at 45 ^{o}C. FTIR spectra were recorded on a Varian Digilab FTS-800 spectrometer. The thermal transition data were obtained by a TA Instruments Q100 differential scanning calorimeter (DSC) at a heating rate of 10 ^{o}C/min. Thermo-gravimetric analysis (TGA) measurements were performed on a TA instruments model 2950 at a heating rate of 20 ^{o}C/min under N_2 from room temperature up to a maximum of 750 ^{o}C. Transmission electron microscopy (TEM) images were taken on a JEOL JEM-1200 EX II TEM equipment. For TEM measurement, the membranes were stained by a saturated lead acetate solution, washed with water and dried under vacuum at 40 ^{o}C for 24 h. The stained membranes were embedded in epoxy resin and sectioned to yield 100 nm thickness using a microtome, and then placed on copper grids.

The tensile stress-strain properties of the cross-linked membranes and Nafion 117 were tested on Instron model 4411 universal testing machine using ASTM D 882-02 method. The wet films were examined immediately after the membranes being soaked in liquid water for 4 hours. Membranes II and III showed elongations at break of 59.5% and 56.25 % respectively at dry state, and 48.6% and 43.7 % respectively at wet state. Moduluses of II and III are 6.9×10^{8} and 7.6×10^{8} Pa at dry state and 9.4×10^{7} and 9.8×10^{7} at wet state.

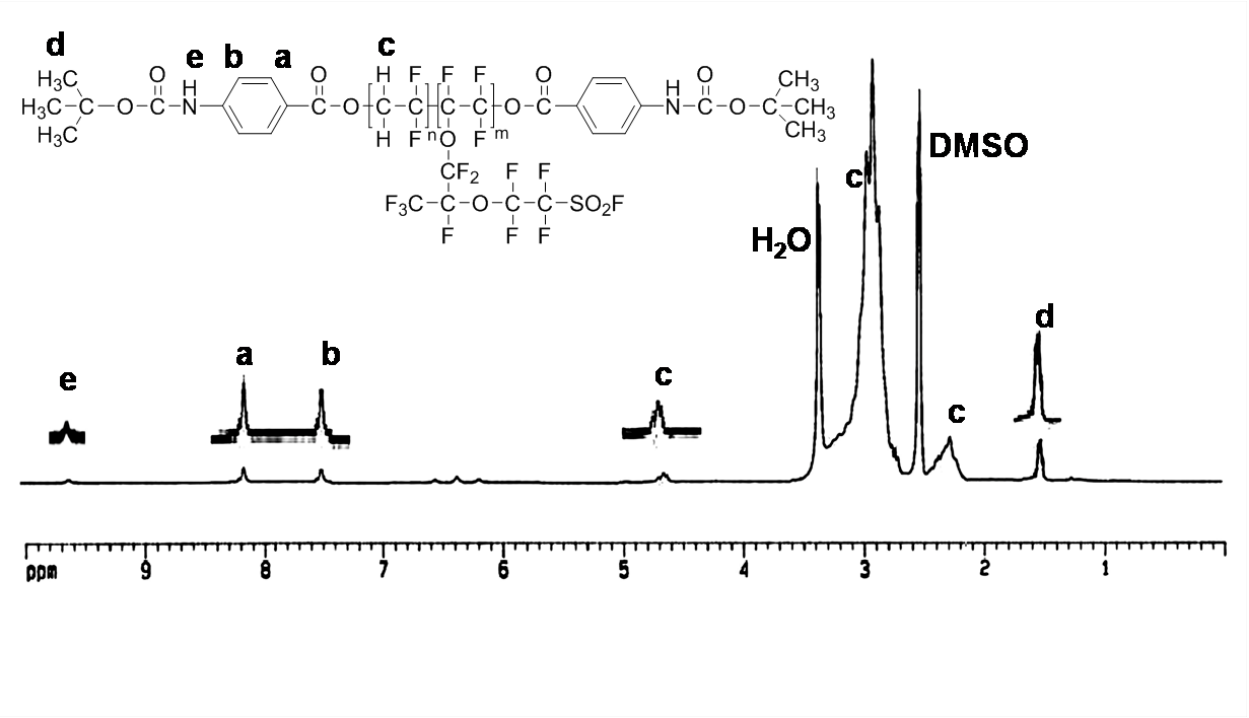

Figure S1. NMR spectrum of the P(VDF-PFSVE) with t-Boc protected amino end-groups.

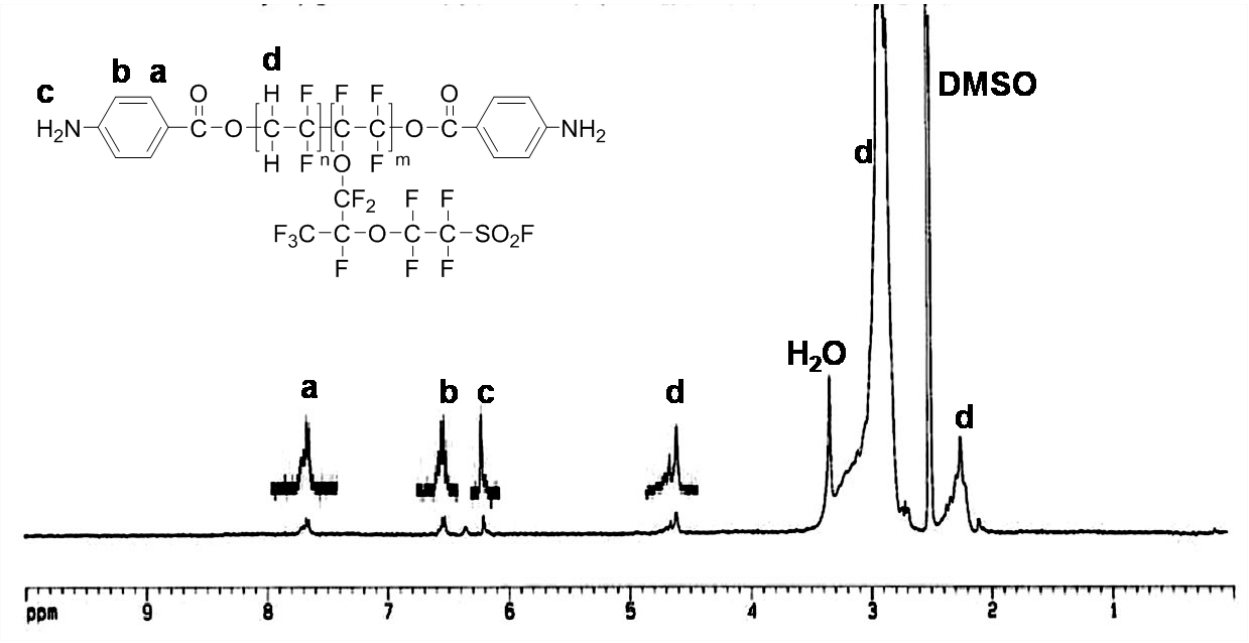

Figure S2. NMR spectrum of the P(VDF-PFSVE) with amine end-groups.

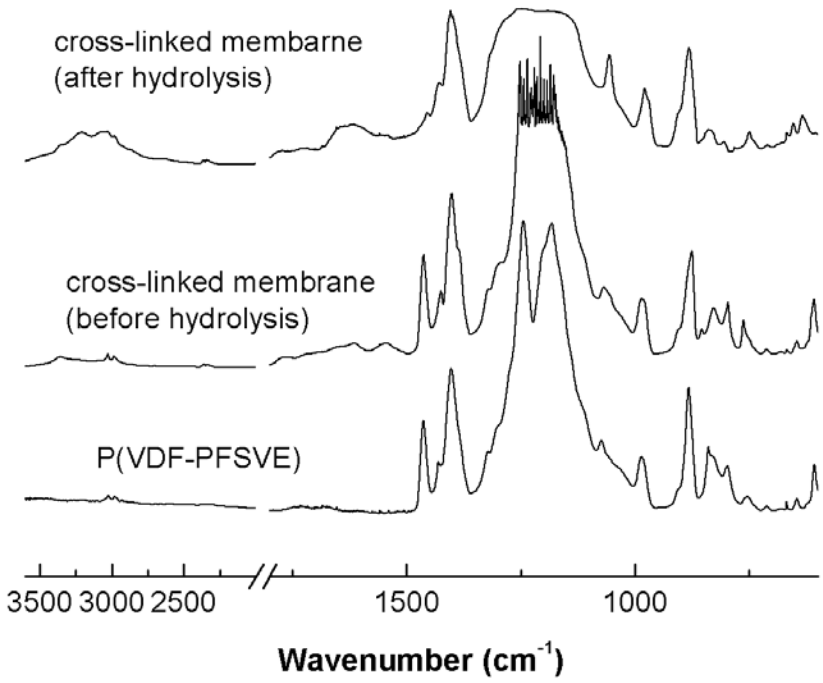

Figure S3. FTIR spectra of P(VDF-PFSVE) and the cross-linked membranes.

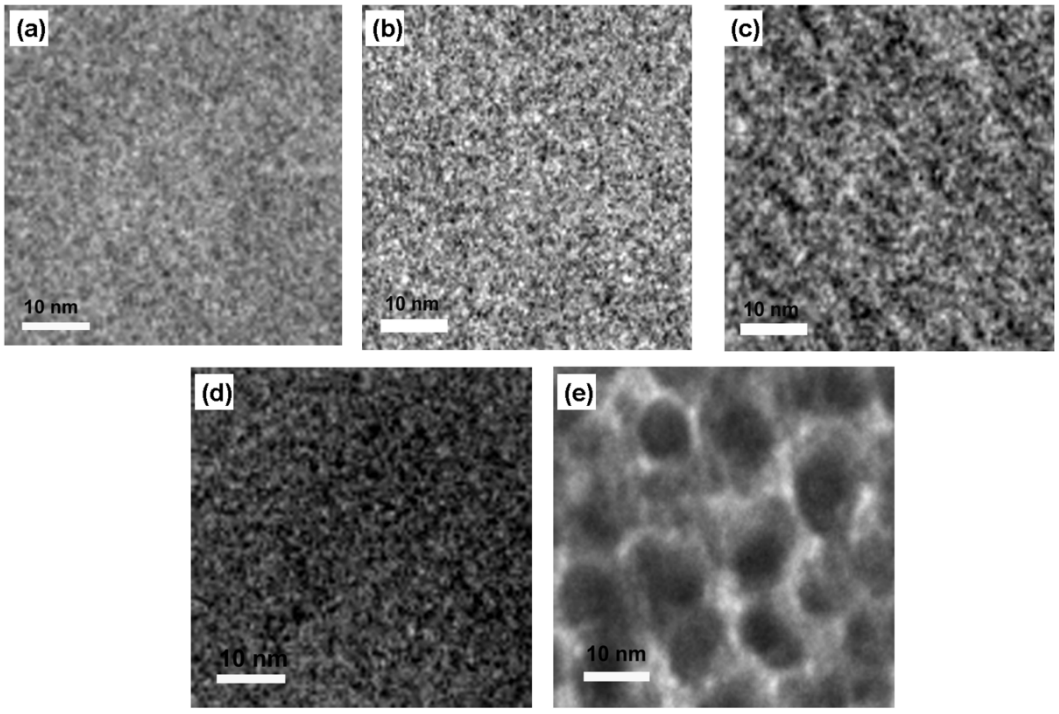

Figure S4. TEM images of the cross-linked membranes and Nafion.

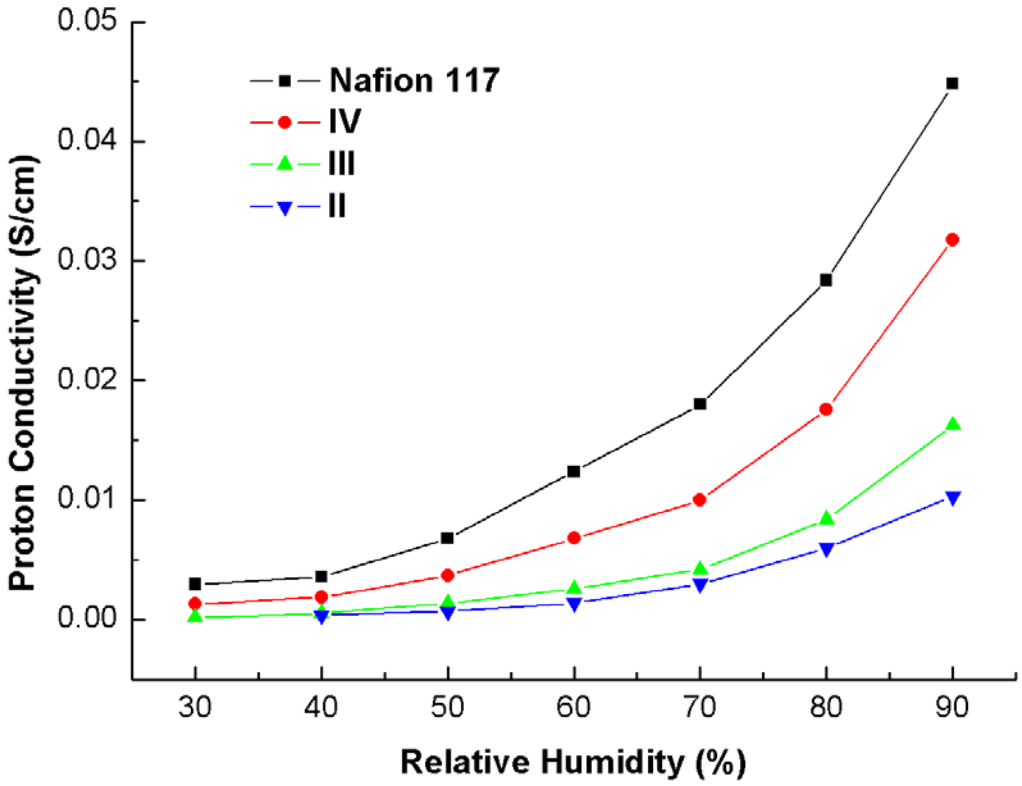

Figure S5. Humidity dependence of proton conductivity of the cross-linked membranes and Nafion 117.