Electronic Supplementary Material (ESI) for Polymer Chemistry.

Supporting Information

Polymer-brush functionalized SiO_2 nanoparticles based Nafion nanocomposites: A novel avenue to low-humidity proton conducting membranes

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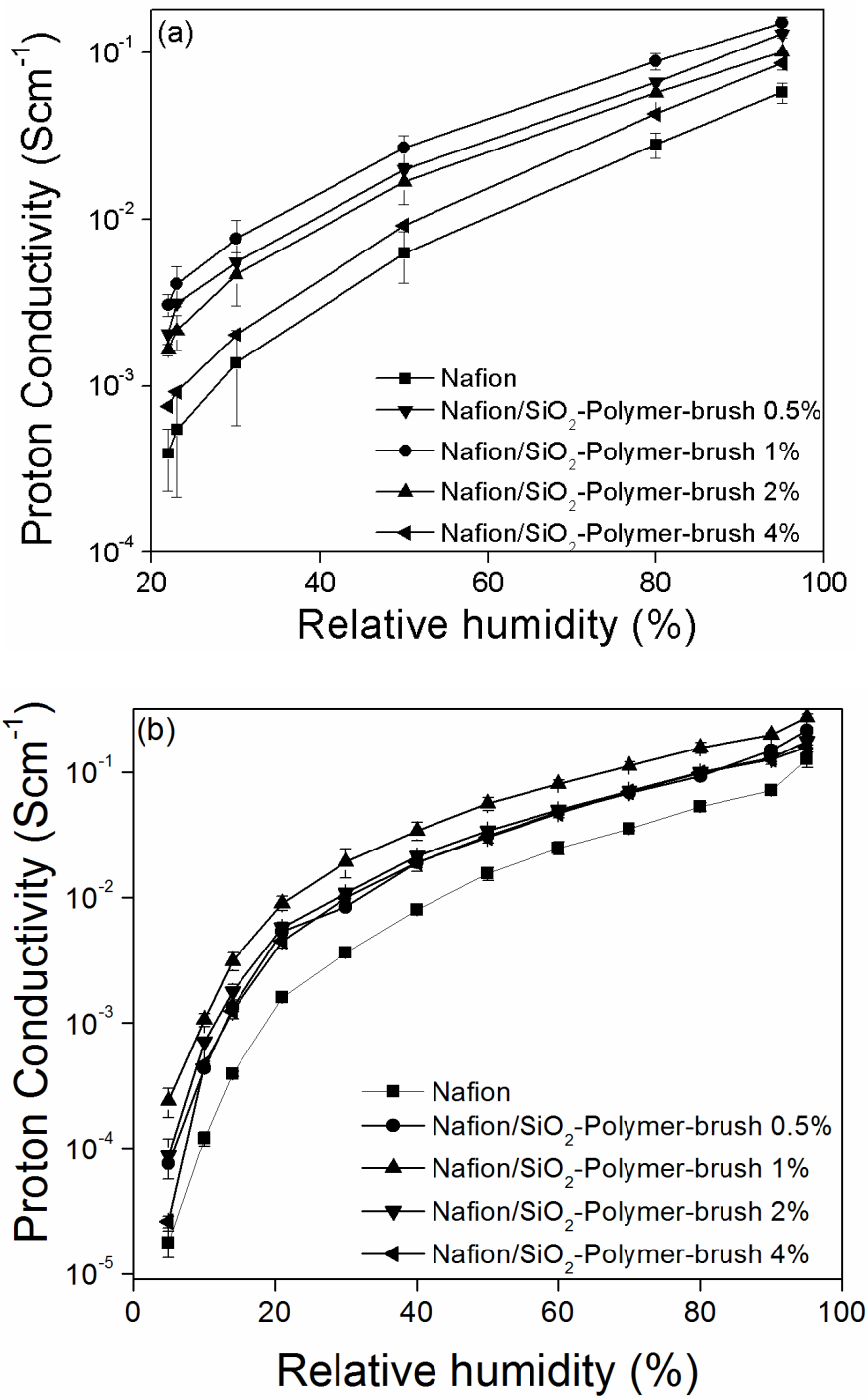

Figure S1. Influence of humidity on conductivity of different nanocomposite of Nafion and Nafion/SiO_2-Polymer-brush nanocomposite PEMs at 25 °C (a) and at 55 °C (b).

Polyelectrolyte Electrolyte Membranes (PEMs)	Proton Conductivity ($mScm^{-1}$) at 25 °C		Proton Conductivity ($mScm^{-1}$) at 55 °C	
	20% RH	**80% RH**	**20% RH**	**80% RH**
Nafion	0.30 (±0.011)	24.5 (±4.03)	1.59 (±0.049)	52.94 (±3.9)
Nafion/SiO_2-Polymer-brush-1%	3.4 (±0.094)	95.4 (±5.22)	9.03 (±1.17)	157.18 (±8.3)
Nafion/SiO_2-1%	2.34 (±0.088)	69.3 (±7.5)	2.67 (±1.14)	130 (±6.7)

Table S1. Proton conductivity data of PEMs at 25 and 55 °C under 20% and 80% relative humidity.

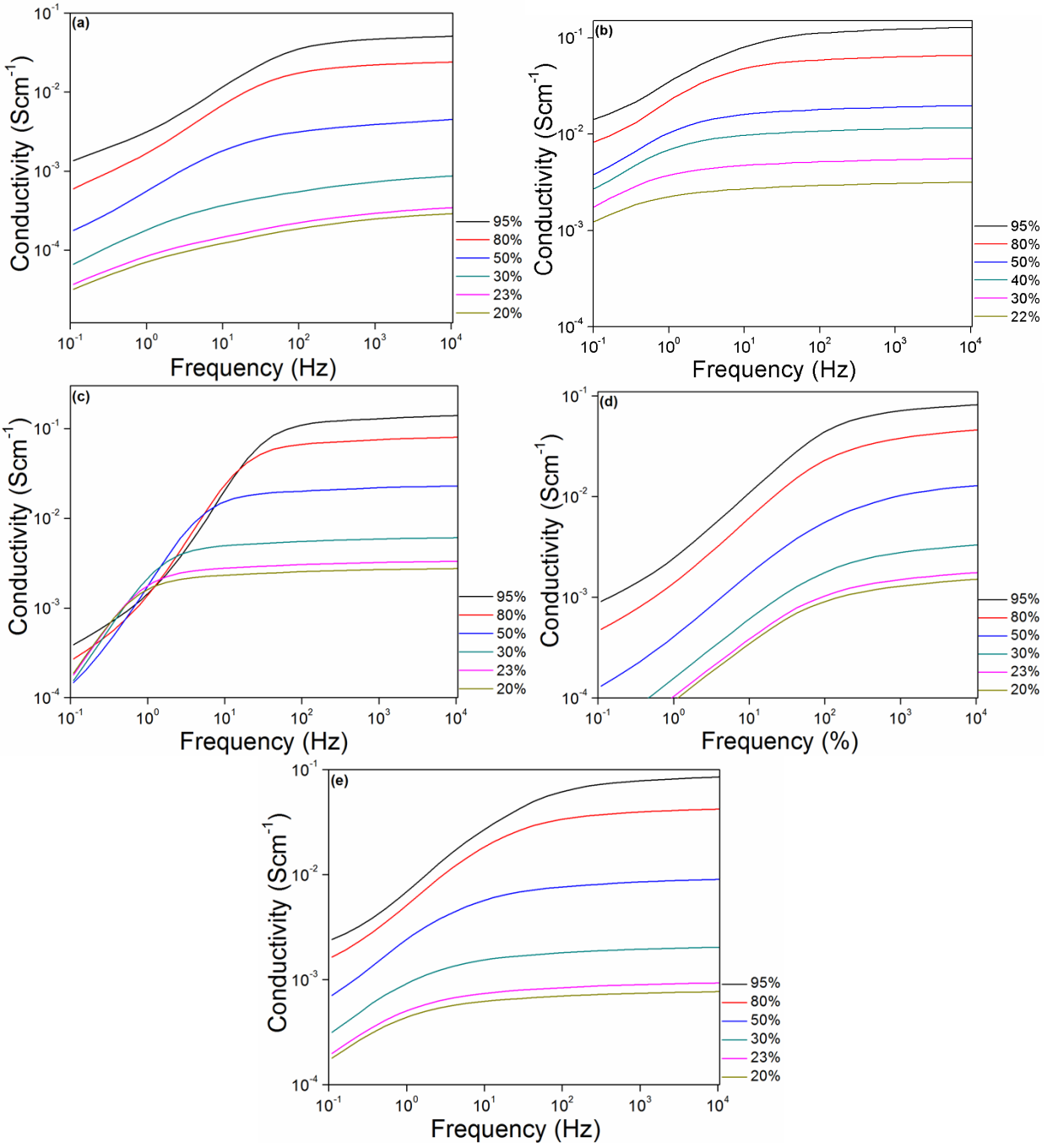

Figure S2. Bode plots at 25°C, Nafion reference (a), Nafion SiO_2-Polymer-brush 0.5% (b), 1% (c), 2% (d), and 4% (e) membranes.

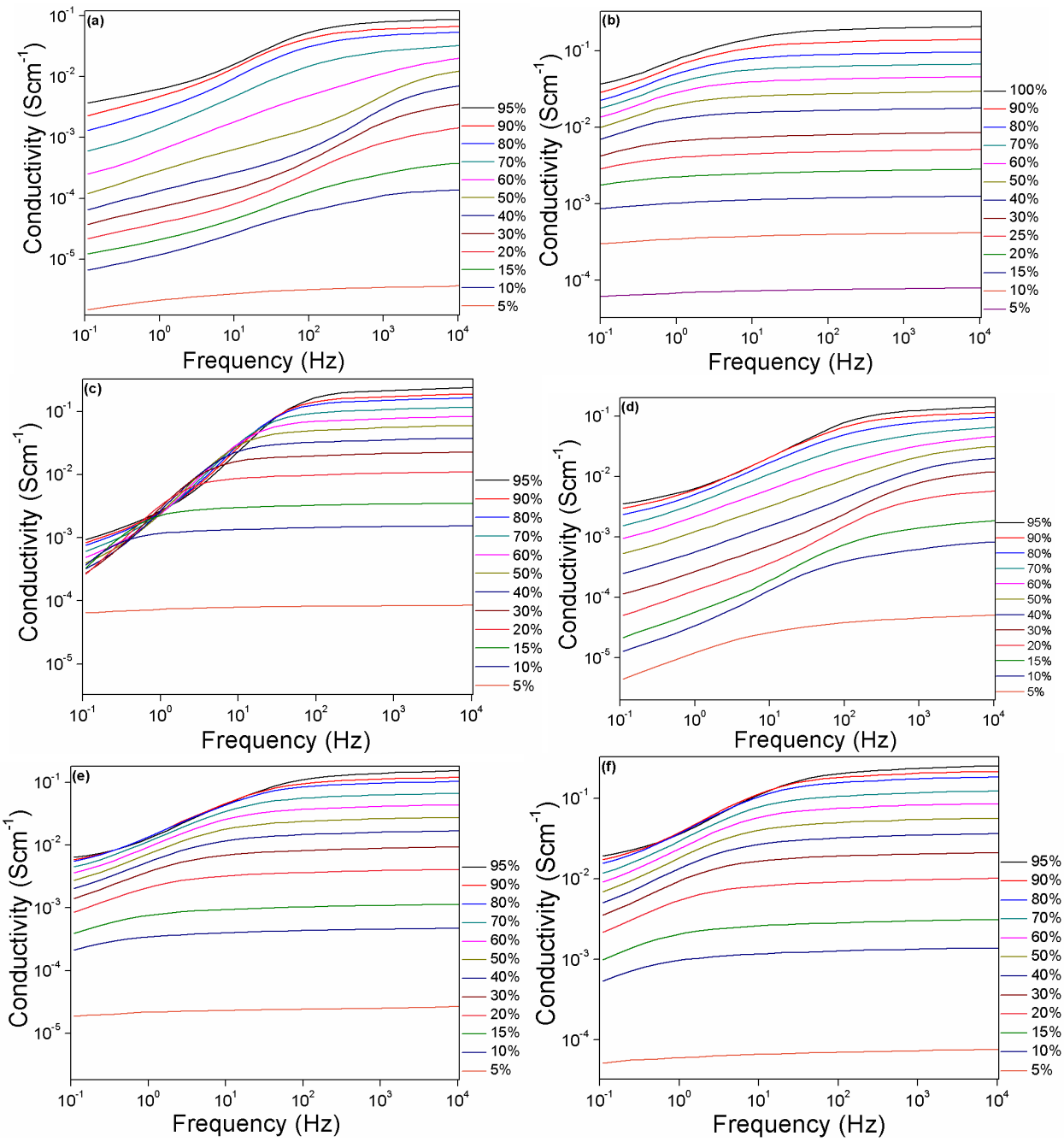

Figure S3. Bode plots at 55°C, Nafion reference (a), Nafion /SiO_2-Polymer-brush 0.5% (b), 1% (c), 2% (d), 4% (e), and Nafion/SiO_2 1% (f) membrane.

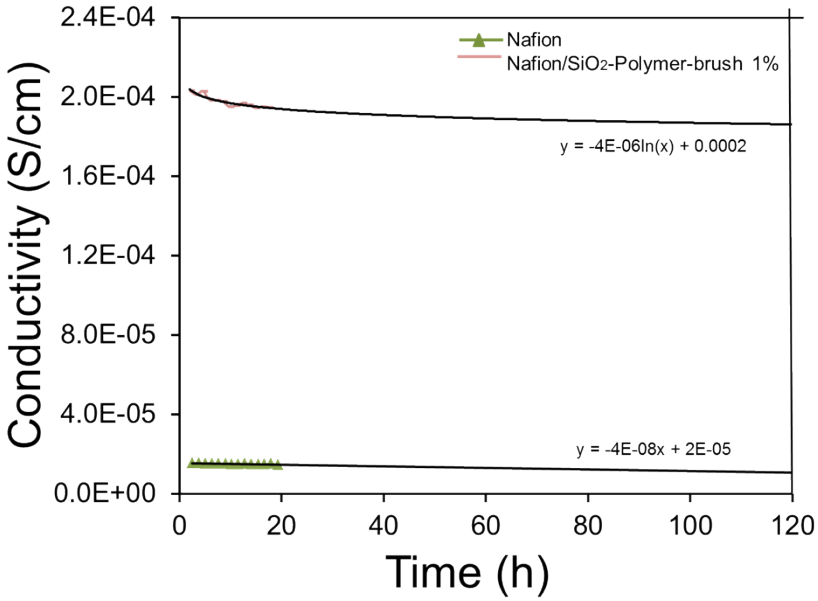

Figure S4: Stability of equilibrium proton conductivities as a function of time at 5% RH and 55°C.

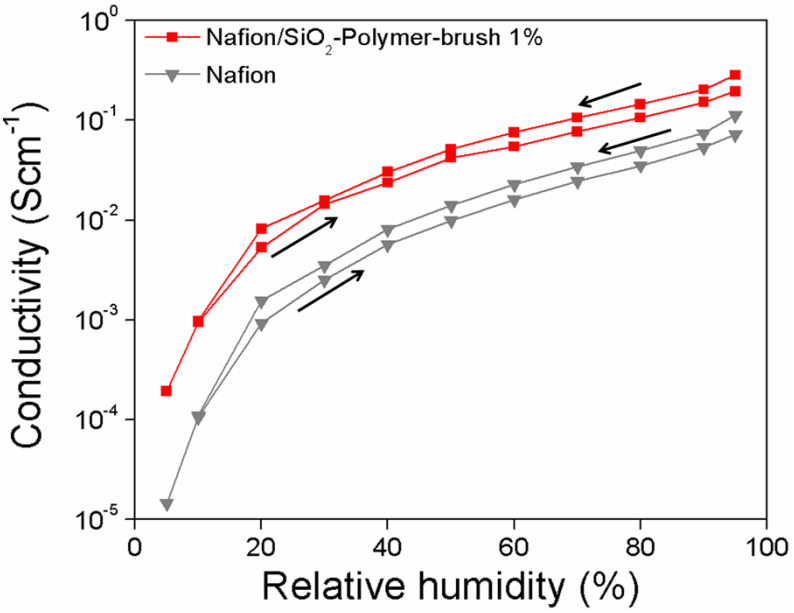

Figure S5: Proton conductivities as a function of increasing and decreasing RH (5%-95%) at 55°C.

Membrane description	Activation energy (kJ/mole) 15%	Activation energy (kJ/mole) 50%	Activation energy (kJ/mole) 80%
Nafion/SiO_2-polymer-brush 1%	26.2	15.9	11.2
Nafion/ SiO_2	28.7	15.6	12.0
Nafion	40.0	21.2	15.1

Table S2: Activation energies of proton conducting membranes used in this study.

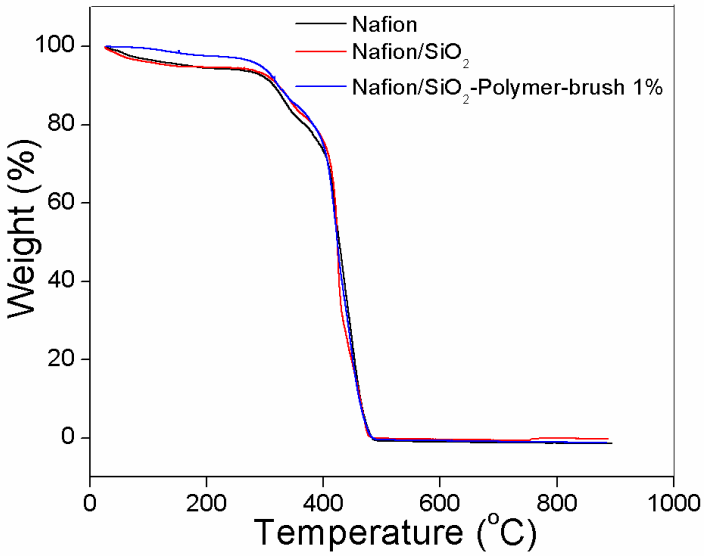

Figure S6: Thermogravimetric analysis (TGA) of proton conducting membranes used in this study.

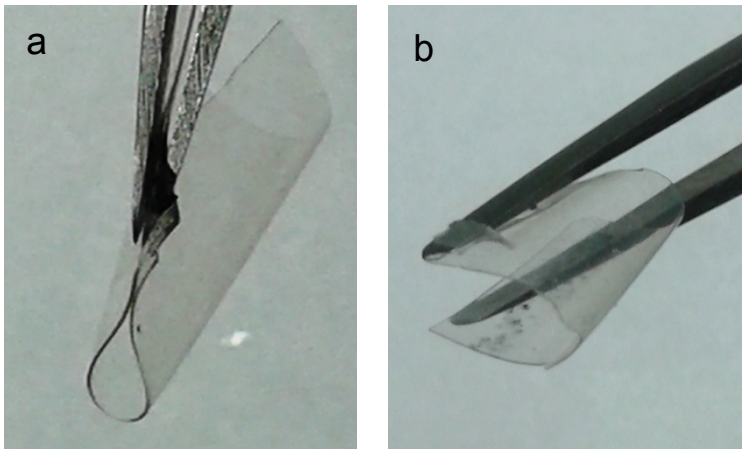

Figure S7: Demonstration of flexibility of fabricated membranes, Nafion (a) and Nafion/SiO_2-Polymer-brush 1% (b).