Supporting information

Shape memory effect in radiation grafted ion exchange membranes

Dirk Henkensmeier,*[a] Lorenz Gubler[b]
[a] Korea Institute of Science and Technology (KIST), Fuel Cell Research Center, Hwarangno 14gil5, Seongbukgu, 136-791 Seoul, South Korea, Tel:+82-2-958-5298; Email:henkensmeier@kist.re.kr
[b] Electrochemistry Laboratory, Paul Scherrer Institute, CH-5232 Villigen, Switzerland

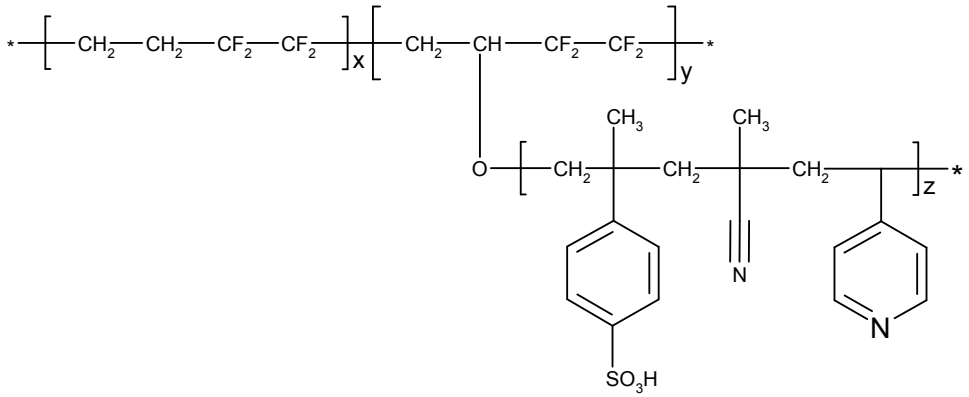

Figure S1: Schematic chemical structure ETFE-*graft*-poly(α-methylstyrenesulfonic acid-*co*-methacrylonitrile-*co*-4-vinylpyridine).

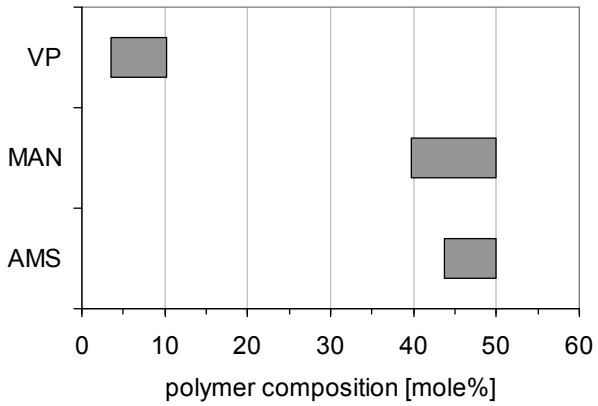

Figure S2: Composition of the graft polymer.

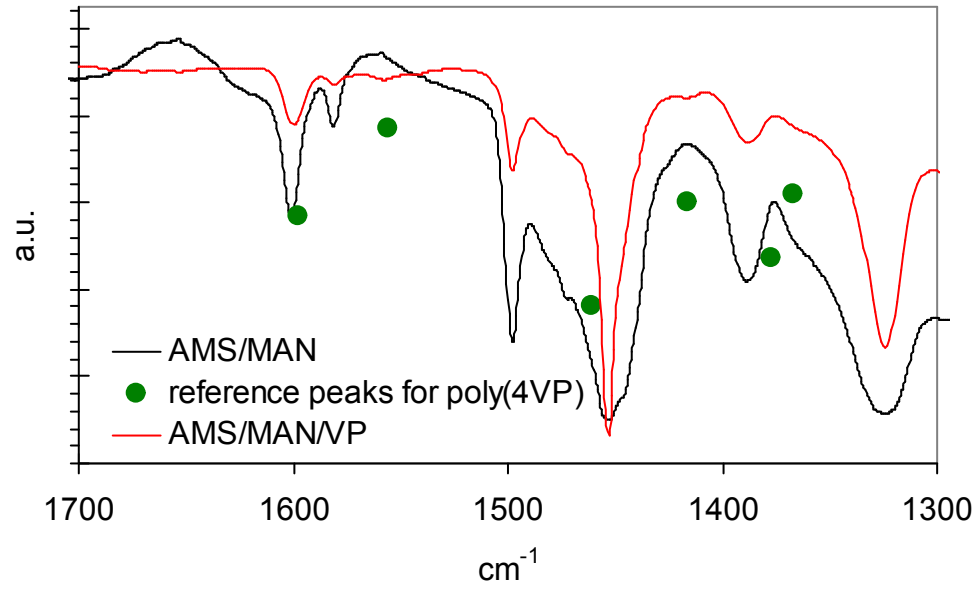

Figure S3: FTIR spectra of AMS/MAN and AMS/MAN/VP grafted films before sulfonation, with a degree of grafting of 54 and 55%, respectively; green dots are reference peaks for poly(4-vinylpyridine)[1].

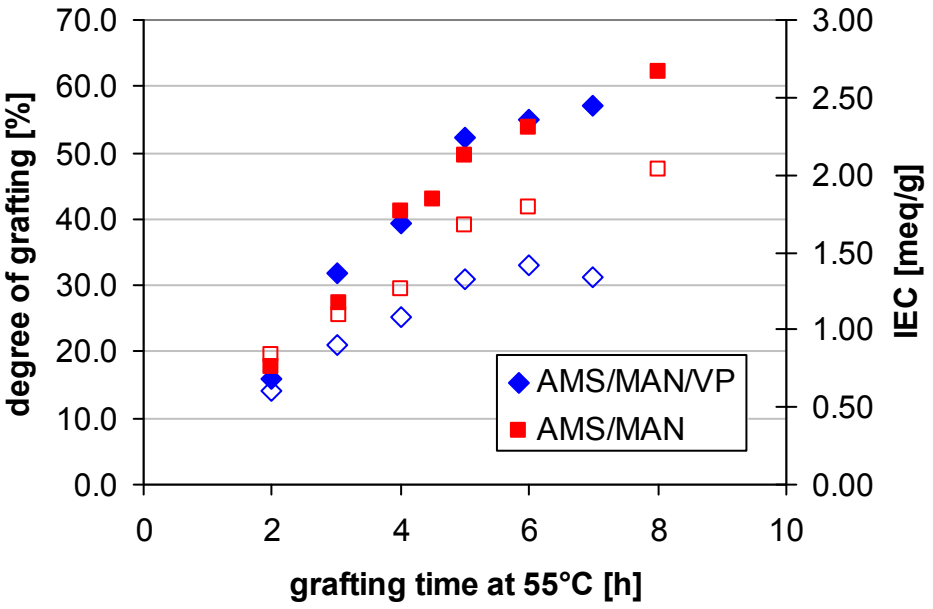

Figure S4: Relation between the IEC, achieved degree of grafting and the grafting time for ETFE grafted with AMS/MAN and AMS/MAN/VP.

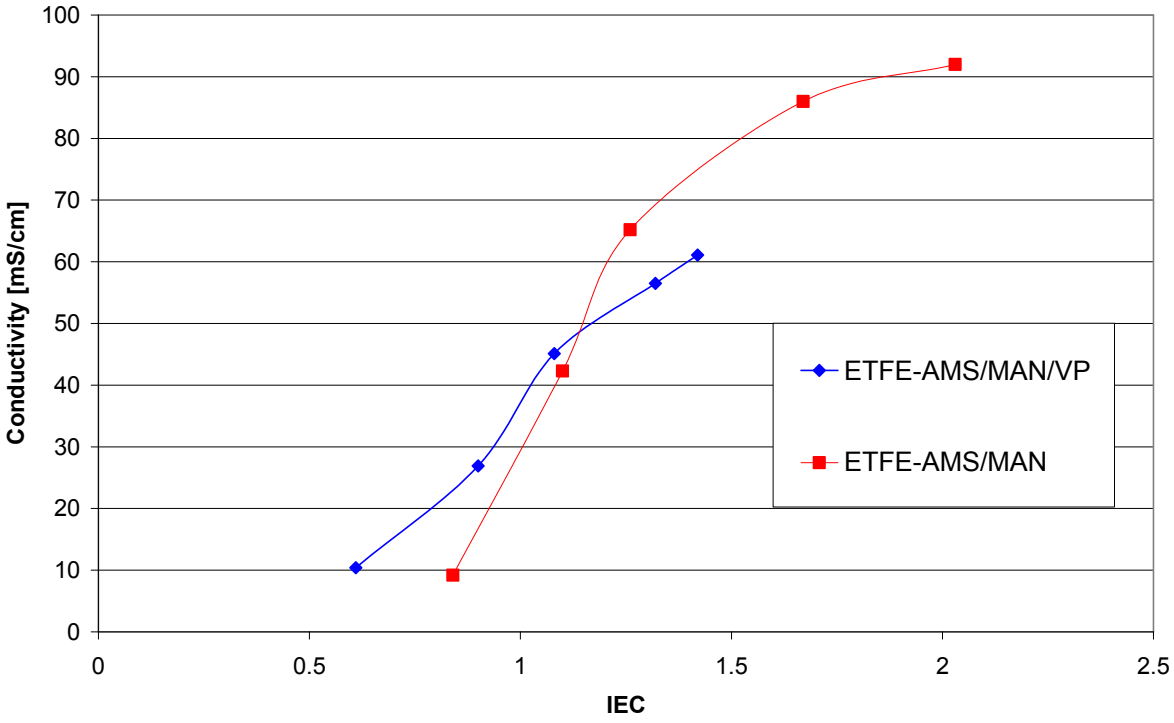

Figure S5. Dependence of the through-plane of conductivity of sulfonated membranes on the IEC.

Fuel Cell test:

6 membranes based on ETFE-AMS/MAN/DVB (1.67 % (v/v) DVB)[2] were prepared. Half of them were dried freely, the rest was dried under constrained conditions. From these membranes, 6 membrane electrode assemblies (MEAs) were prepared by hotpressing two gas diffusion electrodes (GDE) (loading on each GDE 0.4 mg/cm^2) and a membrane at 45 kN and 110 °C for 3 min. Then the MEAs were assembled into a short stack. Each cell consisted of one MEA, two 25 µm thick PEN subgaskets and a 0.1 mm thick PTFE gasket. The stack was tested at 80 °C with H_2 and O_2 as fuel and oxydant, flow rates of 1.5 stoich., a pressure of 2.5 bara, and humidifier temperatures of 80 °C. The first three cells were based on freely dried membranes, the last three cells on membranes dried under fixed geometry.

Table S1: Fuel Cell Performance of freely dried membranes and membranes dried under constrained conditions before MEA preparation.

		freely dried membranes				membranes dried under fixed geometry			
i	**U_stack**	**cell 1**	**cell 2**	**cell 3**	**average**	**cell 4**	**cell 5**	**cell 6**	**average**
mA/cm²	**V**	**V**	**V**	**V**	**V**	**V**	**V**	**V**	**V**
0	6.164	1.028	1.031	1.022	1.027±0.005	1.029	1.032	1.022	1.028±0.005
178	4.606	0.809	0.75	0.714	0.758±0.048	0.808	0.799	0.726	0.778±0.045

References

1. SDBSWeb: http://sdbs.riodb.aist.go.jp (National Institute of Advanced Industrial Science and Technology, 2013.08.09)

2. D. Henkensmeier, H. Ben youcef, F. Wallasch and L. Gubler, *J. Membr. Sci*., 2013, **447**, 228.