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A facile approach to fabricate organosilica layered material with sulfonic groups as efficient filler for polymer electrolyte nanocomposites

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SUPPORTING INFORMATION

As described in the experimental section, the NMR pulsed field gradient stimulated echo (PFG-STE) method was used to measure the ^{1}H self-diffusion coefficients in the membranes. The attenuation of the echo amplitude in this sequence is represented by the equation:

$$I(2\tau_1 + \tau_m) = \frac{1}{2} I_0 exp\left[-\frac{\tau_m}{T_1} - \frac{2\tau_1}{T_2} - (\gamma g \delta)^2 D(\Delta - \frac{\delta}{3}) \right]$$

Figure S1 shows the decay lines of [I(g)/I(0)] vs. g^2(the other parameters are constants) which are used to calculate the self-diffusion coefficients (D), for some representative measurements performed. We can observe that the decay lines are net mono-exponential for both systems as well as for all the investigated temperatures. This feature is very important in order to use the above equation to calculate D, and to confirm the Gaussian self-diffusion behaviour. Furthermore, it supports the consequence that in such complex systems, we measure only one diffusion value, which is a weighted average from the different protons species in fast rate of exchange.

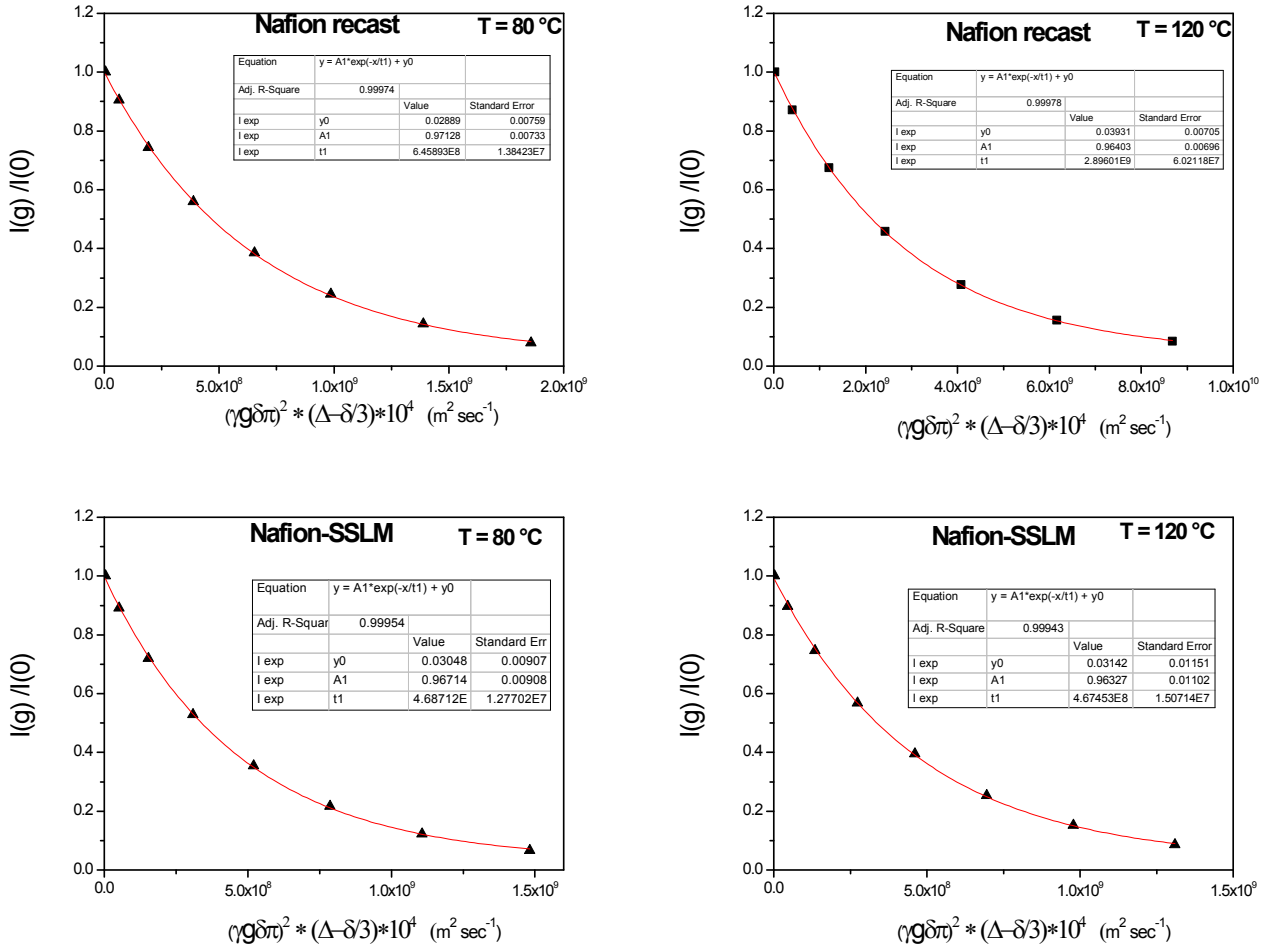

Figure S.1. *Decay lines of [I(g)/I(0)] vs. $(\gamma g\delta)^2(\Delta-\delta/3)$ of the twp Nafion-based membranes.*

Figure S2 shows the high-resolution spectra of Sulphur 2p (**Figure 1**) where the main photoelectron peak is deconvoluted into two peaks the one attributes to the SO3- groups that decorate the lamellar structure of the SSLM and the other one from sulfonate groups attached to Na species. The ratio of $SO_3^-Na^+$ to SO_3^- is approximatelt 2/1.

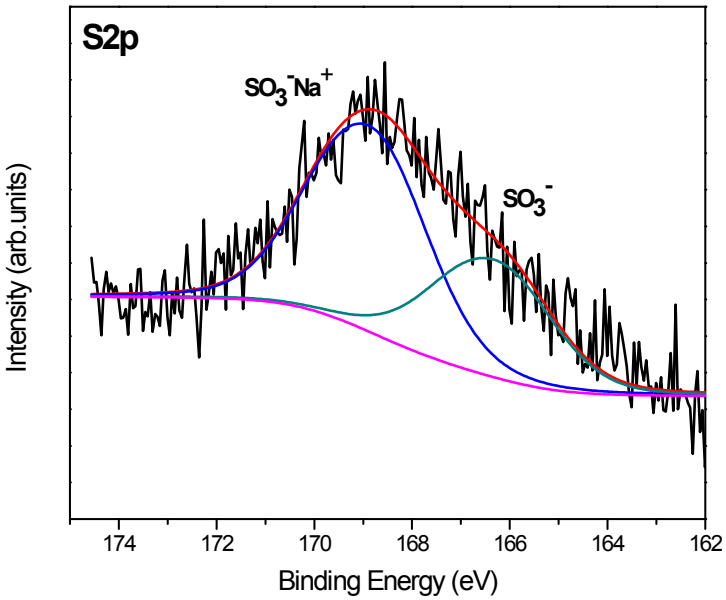

Figure S2. S2p photoelectron spectra of SSLM

Then **Figure S3** we present the high-resolution C 1s photoelectron spectra of the synthesized SSLM. From the fitting of the spectrum we detect two clear peaks, the one at lower binding energy (284.6 eV) due to the C-C chain of the organo-sulfonic groups and a second one at 286.0 eV attributed to the C-S bonds. The ratio of C-C to C-S has been estimated to 4.3 (C-C/C-S).

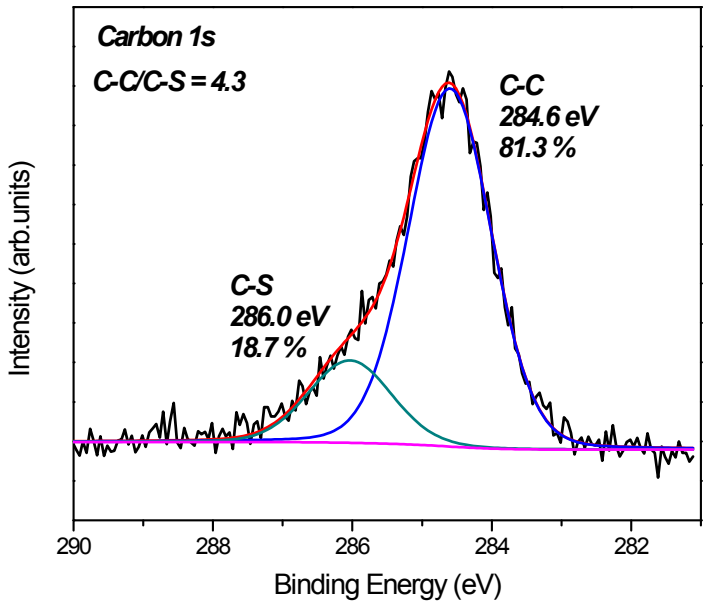

Figure S3. C1s photoelectron spectra of SSLM