



## Impact of sPEEK pretreatment on proton exchange membrane fuel cells performances

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Proton exchange membrane fuel cell (PEMFC) is one of the most promising solutions to produce hydrogen-based energy for stationary and automotive applications. Over the past decades, many works have been devoted to the development of lower cost hydrocarbon (HC) membrane electrolyte as alternatives to PFSA. Among them, sulfonated poly(ether ether ketone) (sPEEK) membrane are cheap, offer good mechanical properties and a high proton conductivity<sup>1,2</sup>. Before use, sPEEK membranes must be activated to remove residual reagents and solvent. This is generally done by soaking sPEEK membrane in H<sub>2</sub>SO<sub>4</sub> at a temperature close to 80°C or at room temperature. In addition to the activation or cleaning step, many works have highlighted the interest of a supplementary hydrothermal treatment in water at high temperature for a few hours to a few days to improve the microstructure, favoring thus the proton conductivity. Herein, we studied the effect of membrane activation on fuel cells performances using two different batches (named old and new) from the same manufacturer. Three different protocols are employed, the first one -named Act 1- is based on the immersion of the membrane in 1M H<sub>2</sub>SO<sub>4</sub> solution at 80°C for 4 hours. The second -named Act 2- is based on the immersion of the membrane for 16 hours in 1M H<sub>2</sub>SO<sub>4</sub> solution at 80°C, followed by an immersion in water at 80°C for 1 hour. The third -named Act 3- is based on the immersion of the membrane for 4 hours in 1M HCl and includes an hydrothermal treatment for 72h at 80°C according to H. Mendil-Jakani et al.<sup>3,4</sup>.

The results demonstrated that the best fuel cell performances are obtained with the new batch of sPEEK with the second activation protocols -Act2-: in addition to the best performances, the MEA had also the lowest high frequency resistance  $R_{hf}$ , which could be explained by better membrane nano-structuration and thus better protonic conductivity. The polarization curves and  $R_{hf}$  of the old and new sPEEK demonstrated that the performances of the new batch are much better than those of the old one with the first activation protocol -Act 1-, which can be attributed a better ionic conductivity.

### References:

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