Space/time-resolved water dynamics in the Proton Exchange Membrane of working Fuel Cells

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Proton Exchange Membrane Fuel Cells (PEMFCs) are among the most promising candidates for an envitomental-friendly hydrogen-based technology. Nevertheless, to optimize PEMFCs performances one major problem that must be solved is water management, being the membrane protonic conductivity highly dependent upon its water content[1]. On the other hand, only a few experimental techniques aimed at measuring the water distribution in the membrane are available[2]. Here, the results obtained by applying an original method based on the use of very high energy synchrotron radiation (available at the ESRF ID15 beamline) are presented [3-6]. This latter approach permitted a time-resolved vertical stratigraphy of the FC membrane, ideally slicing it in layers (anode to cathode and reverse), to be performed. In this way, a real time stratigraphic imaging was performed, allowing hydration degree changes in each layer to be determined, at the highest accuracy ever achieved. The results provided a precise description of the time-dependent water distribution inside the PEM in the different experimental conditions in which FCs may operate.

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