A modified Proton Exchange Membrane Fuel Cell for in operando SAXS and XAS

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Catalyst stability at the cathode side of Proton Exchange Membranes Fuel Cells (PEMFCs) is strongly affected from the harsh environment in which the Oxygen Reduction Reaction takes place and it is strongly limiting their commercial diffusion[1–3]. Significant improvements in this field could be achieved by a better understanding and discrimination among the several degradation processes which are overlapping during fuel cell operation[4,5]. Such a goal could lead to the development of new mitigation strategies for reducing catalyst degradation over time, thus increasing PEMFCs lifetime and reducing hydrogen consumption. In this framework, Small Angle X-Ray Scattering (SAXS) and X-Ray Absorption Spectroscopy (XAS) performed at synchrotron facilities can play a key role in providing complementary morphological and chemical information. In this framework, a modified PEMFC system is being designed for in operando analysis SAXS and XAS analysis to be performed at ELETTRA synchrotron in Trieste, for advanced catalyst characterization and is here presented.

References

1. Zhang, Q. & Guan, J. Adv. Funct. Mater. **30**, (2020) 1–53 (https://doi.org/10.1002/adfm.202000768).
2. Asset, T. et al. ChemPhysChem **19** (2018) 1552–1567 (https://doi.org/10.1002/cphc.201800153).
3. Wang, Y., Ruiz Diaz, D. F., Chen, K. S., Wang, Z. & Adroher, X. C. Mater. Today **32** (2020) 178–203 (https://doi.org/10.1016/j.mattod.2019.06.005).
4. Ishiguro, N. & Tada, M. Catal. Letters **148** (2018) 1597–1609 (https://doi.org/10.1007/s10562-018-2383-7).
5. Garcia-Sanchez, D. et al. Appl. Energy **259** (2020) 114210 (https://doi.org/10.1016/j.apenergy.2019.114210).