

Experimental investigation of performance degradation on an open cathode Proton Exchange Membrane Fuel Cell stored at sub-zero temperatures

Yi FANG^{1,2}, Samir JEMEI^{1,2}, Brigitte PEREZ³, Daniel HISSEL^{1,2}, Michel BENNE³, Jean-Pierre CHABRIAT³, Rafael GOURIVEAU^{1,2},
Nouredine ZERHOUNI^{1,2}

¹ FEMTO-ST, CNRS, Univ. Bourgogne Franche-Comte, ENSMM

² FCLAB, CNRS, Univ. Bourgogne Franche-Comte, F-90010 Belfort Cedex, France

³ LE2P, EA 4079, Univ. La Reunion, BP 7151, 97715 Saint-Denis, France

The Proton Exchange Membrane Fuel Cell (PEMFC) is one of the most developed fuel cell technology in recent years while the durability of PEMFCs remains as a main factor that restricts their commercialization at a larger scale [1]. This issue becomes even more challenging in regions with extreme cold winter or wet tropical climate. Prognostic tools are also needed to predict the state of health and to estimate the Remaining Useful Lifetime (RUL) of fuel cells, in order to make the systems more reliable and cost effective.

Certain researches [2-4] have shown performance losses of PEMFCs after suffering freezing-thaw cycles. During the freezing state, the formation of ice could lead to irreversible degradations and reduce largely the durability of PEMFCs. In this work, a test bench has been designed in lab to characterize two identical PEMFCs, by performing polarization curve and Electrochemical Impedance Spectroscopy (EIS). One fuel cell will undergo temperature cycles as low as -30°C and will be compared to the other fuel cell stored under normal conditions. An algorithm of prognosis based on Reservoir Computing (RC) will be tested with the experimental data.

References

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