Characterization methods for PEMFCs used at Nedstack Fuel Cell Technology

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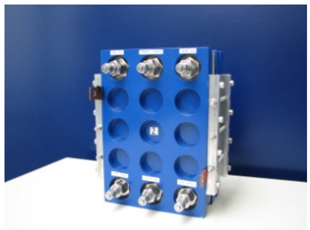
INTRODUCTION

NedStack is one of the largest European producers of PEM fuel cell stacks. All the stacks were characterized for their beginning of life (BOL) before delivered to the customers and also after they turned back for their end of life (EOL) analysis. In addition to the stack production, NedStack conducts R&D on new fuel cell components. Therefore several characterization methods have been applied to screen these materials either on a single cell or a large stack and either as an *ex-situ* or *in-situ* method.

STACK HARDWARE

Commercially available 75-cell stack of NedStack, currently also in use for durability studies.



Stack hardware for R&D.

RESULTS & DISCUSSION

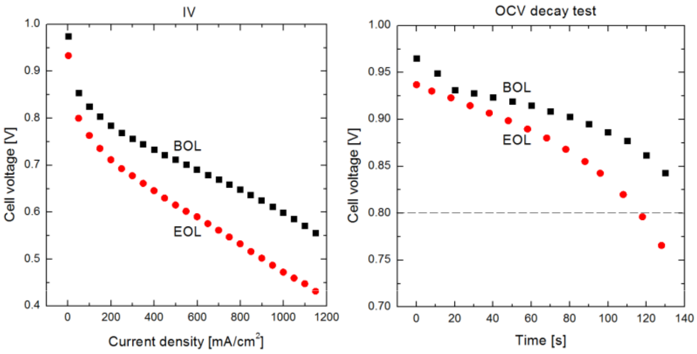


Figure 1. IV and OCV leak test data of the 75 cell stack.

Figure 1 shows the IV and OCV decay test results of the 75 cell stack (each point is an average of 75 cells). One can clearly see that the BOL performance of the stack is better than the EOL (after several thousand hours of operation) due to its lower kinetic and ohmic losses, which can also be seen in the impedance data. OCV leak test is a simple internal test protocol to see whether the stack is gas tight. If the OCV is above 0.8V for 120 seconds than it means that the stack is tigth enough to continue analysing.

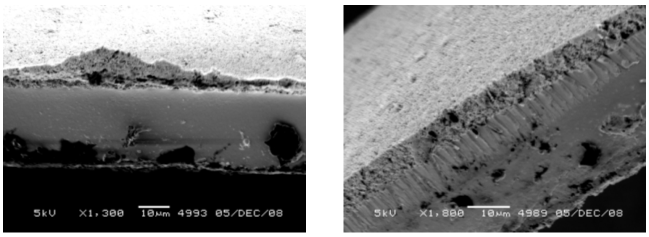


Figure 2. Cross-section SEM images of an MEA.

Figure 2 shows the cross-section SEM images of an MEA sample. Although they are fresh, they have severe defects. These defects will lead to a decrease in the stack performance. Therefore, a careful selection of the stack components is important and SEM is a powerful tool to analyze the MEA structure.

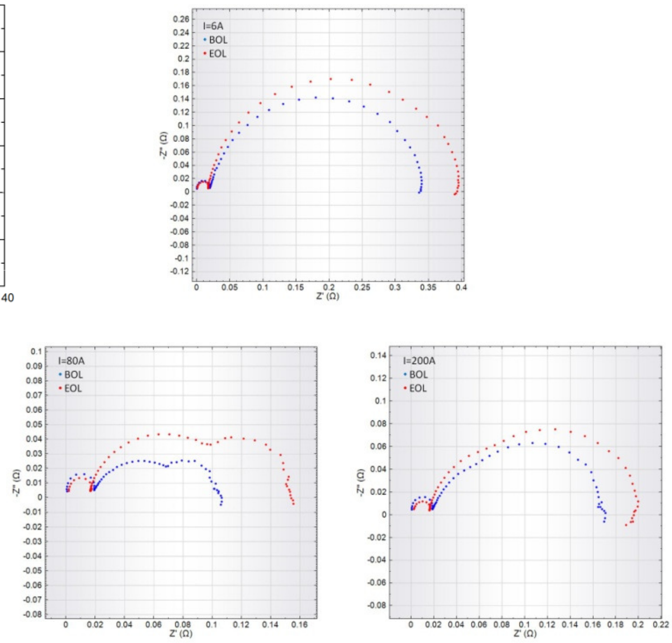


Figure 3. Impedance data on the 75 cell stack at several working points.

Figure 3 shows the impedance data of the stack at 6A, 80A and 200A working points. At 6A, the kinetic losses are visible, when the current increases further then the mass transport losses also become visible. Both kinetic and mass transport losses increase at the EOL of the stack. These impedance measurements can either be performed on a single cell or on cell groups in a 75 cell stack.

Summary

NedStack Fuel Cell Technology is capable of conducting analysis on their stacks using above mentioned methods, but still looking for new, cost effective, *in-situ* techniques to perform faster characterizations.

ADDITIONAL TOOLS

In addition to the above mentioned methods, Nedstack uses additional test tools like accelerated stress tests on the catalyst and the carbon support, CV measurements for the ECSA, H_2 cross-over measurements and EDX Pt mapping to characterize its PEMFC stacks and its components.

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