Troubleshooting Basic Fuel Cell Testing Problems
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Overview:

During testing of fuel cells, sometimes current cannot be successfully applied. This leads the researcher to question whether there is a problem with the fuel cell or the test station. This document describes some basic checks and tests to verify the functionality of the test station when used with a typical single PEM fuel cell.

Verifying Cell Connections:

The user should first verify that the fuel cell is attached with large gauge wire to the test station's '+' and '-'terminals. Normally, 4 gauge (4 AWG) wires are used for a test system operating at up to 50A and 0 gauge is suitable for test stations with 100A capacity. Special cables are available from Scribner Associates for testing large cells at currents of up to 500A. See the test station manual for connection diagrams and instructions. The cell Sense + (red) and Sense – (black) small leads should also connect to the cell's terminals.

Verifying Fuel Supply:

The user should verify that the anode and cathode flow rates are set sufficiently high to provide the cell with the fuel and oxidant it needs. For a flow-through cell (the typical configuration for single-cell testing), a stoichiometry ratio of greater than one is required since some fuel and oxidant is not consumed by the fuel cell. Inadequate fuel supply settings can cause a reasonable cell voltage under open-circuit or light load conditions but a cell voltage collapse when cell current is increased.

Verifying Operation of Test Station:

If cell connections and fuel supply settings are verified to be correct but the fuel cell will not support a current applied, the following test can determine if the problem is with the fuel cell or test station. This test can be helpful if the cell cannot even operate at 1 or 2A in constant-current mode without triggering a low voltage shutdown alarm.

First, disconnect the cell cables and sense leads from the fuel cell (keep them connected to the test station). The fuel supply and exhaust hoses and cell heater and thermocouple wiring can remain attached to the fuel cell.

Next, connect the cell cables and sense leads to a fresh (new) alkaline D cell battery as shown in Figure 1. Use rubber bands or a battery holder to secure the main terminals and sense leads to the battery with the red wires on the positive '+' end and the black wires on the '-' end of the battery. It is not necessary to connect the green and white sense wires for this test.

Start the FuelCell software and click Apply Fuel and Apply Load. Squeeze the terminals against the battery to ensure they make electrical contact and note the cell voltage (whole cell) reported by the software. For a new battery, it should be about 1.5 to 1.6 volts. Set the Current slider in Background to 1A. The Current display should stabilize at 1.00. The cell voltage should drop to about 1.2-1.4 volts for a typical battery.

The battery should be able to supply a 1A current for several minutes, although the cell voltage will slowly drop. Next, set the current to 5A. It should be possible to get this amount of current from the battery for at least a short time. A typical cell voltage under this condition may be 1.1 to 1.4 volts. Click Stop Load and Stop Fuel.

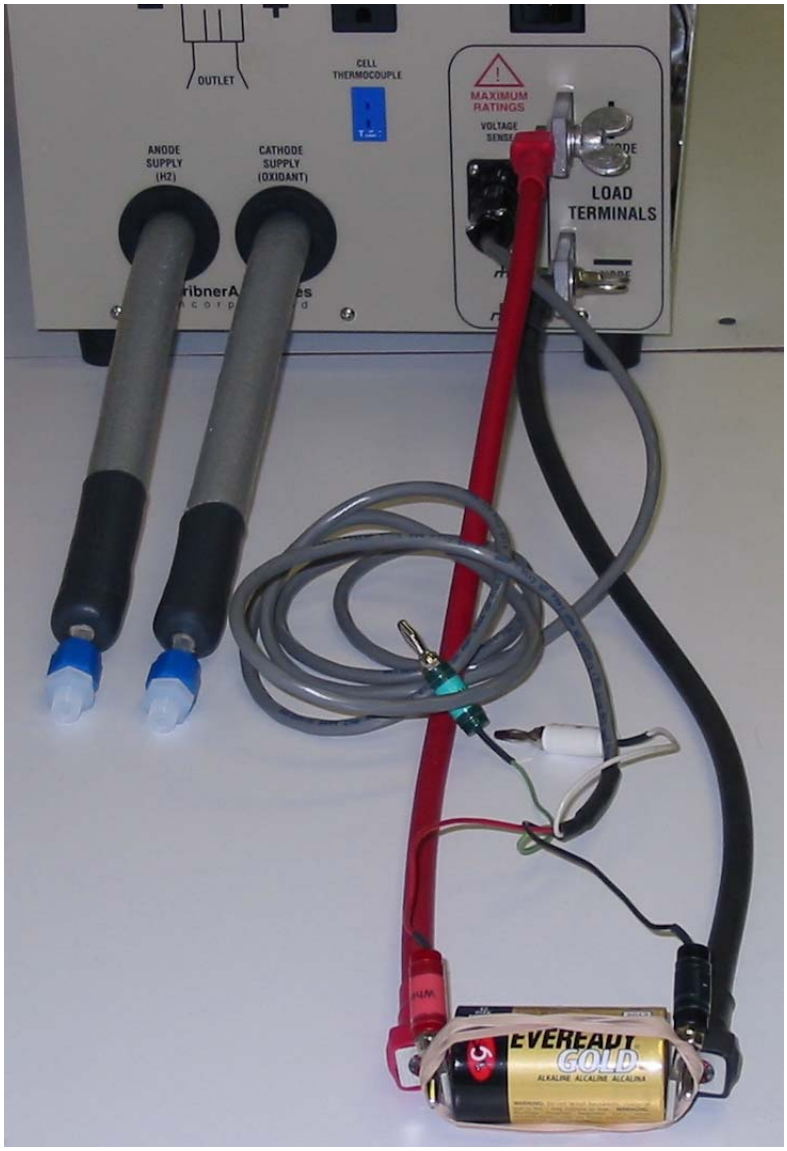

Figure 1 – Battery Connection to Test Station

Conclusion:

If the test station applied a 1A or 5A load to a battery and there are no problems with the anode and cathode fuel supply, the test station will also be able to apply the same load to a fuel cell. If the fuel cell will not operate at these currents, there is a problem with the fuel cell. If the battery test does not work as described, there may be a problem with the test station and Scribner Associates should be contacted for technical support.