

Application Note – MTS 740 Cell Resistance Values for SGL 25BC GDL

Scribner Associates, Inc.

Summary

Table 1 provides MTS 740 Cell Resistance values when using SGL 25BC (SGL Carbon SE) for a perfluorosulfonic acid (PFSA)-based membrane material. Cell resistance (R_{cell} , $\Omega\text{-cm}^2$) values are used to correct the measured high frequency resistance for non-membrane ohmic contributions as described in the MTS 740 user manual. Experimental details are described below.

Table 1. Cell resistance R_{cell} ($\Omega\text{-cm}^2$) for SGL 25BC.

RH, %	30 °C, $\Omega\text{-cm}^2$	80 °C, $\Omega\text{-cm}^2$	120 °C, $\Omega\text{-cm}^2$
95	0.0191	0.0108	0.0131
90	0.0248	0.0123	0.0161
80	0.0376	0.0154	0.0225
70	0.0546	0.0271	0.0315
60	0.0776	0.0411	0.0451
50	0.1309	0.0675	0.0709
40	0.2157	0.0927	0.1125
30	0.4084	0.1806	0.1911
20	1.0716	0.2790	0.4174
10	5.3938	1.1446	0.9862
30	0.4735	0.1656	0.2028
50	0.1272	0.0639	0.0778
80	0.0365	0.0210	0.0277
95	0.0187	0.0120	0.0179

Experimental Details

Cell resistance was determined as a function of temperature and relative humidity (RH) using two sets of PFSA-based materials of different thicknesses. Each set of ionomer had nominally the same equivalent weight. Test temperature and pressure are summarized in Table 2. Additional test conditions were,

Membrane thickness (μm)	Set #1: 18, 38 and 58; Set #2: 25.4, 88.9, 127, 178
Replicates	4-5
Conditioning	1 hour @ 80% RH
RH steps (%)	95, 90, 80, 70, 60, 50, 40, 30, 20, 10, 30, 50, 80, 95
Step duration (min)	30
H _{2(g)} flow rate (SLM)	0.5
Impedance	10 MHz to 1 Hz, 0 V _{DC} , 25 mV _{AC}
Impedance Analyzer	N4L PSM 1735 + Impedance Analysis Interface (IAI)

Table 2. Temperature and pressure during RH cycles.

Temperature, °C	30	80	120
Pressure, kPa _{abs}	101	101	230

Assumptions

Implicit assumptions of the analysis were:

1. The intrinsic conductivity of the membranes was the same such that for a given temperature and RH, the only source of difference in the measured high frequency resistance was the membrane thickness. This is a reasonable assumption given that the equivalent weight of the ionomer was the same for each set of membranes.
2. The cell resistance was independent of membrane thickness.

Disclaimer

To the best of our knowledge, the cell resistance R_{cell} values in Table 1 are accurate and valid for PFSA-based materials. Scribner Associates, Inc. disclaims any and all responsibility for errors introduced due to application of the cell resistance values. This disclaimer applies to both direct and consequential outcomes.