Membrane Test System - MTS 740

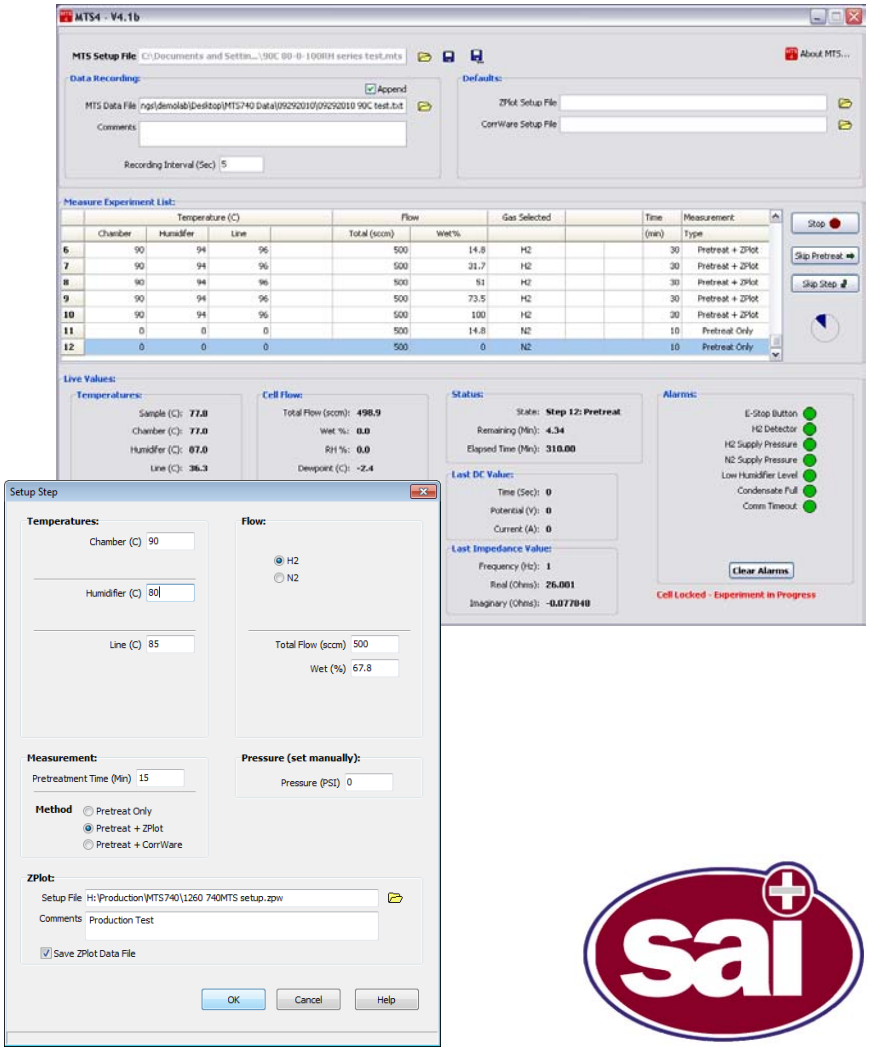
A Versatile Tool for Membrane R&D and Manufacturing QC

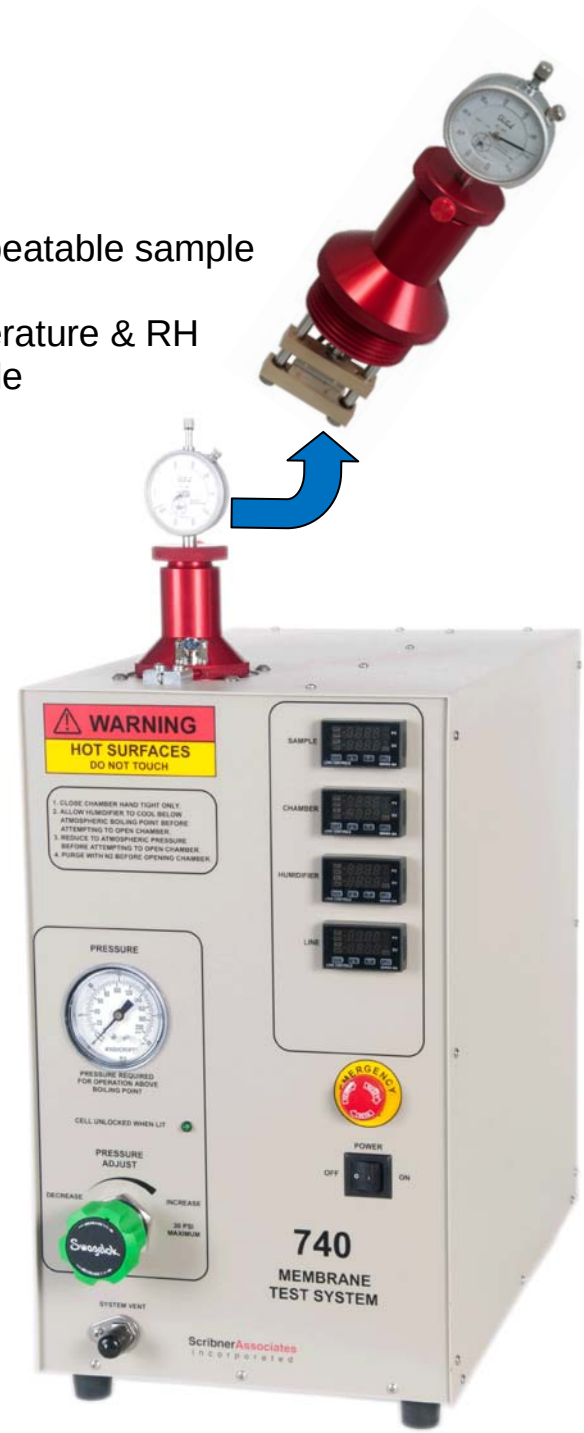
The MTS 740 is ideally suited for development of new ionomers and solid electrolytes. It offers rapid and accurate measurement of the through-thickness membrane resistance and conductivity as a function of temperature, humidity level and pressure.

The MTS eliminates the time consuming approach of catalyzing a membrane and assembling a fuel cell to evaluate the ionomer performance.

Benefits and Features

- ✓ Uses bare (non-catalyzed) membranes
- ✓ Small sample size 6 mm x 30 mm
- ✓ Spring-loaded sample compression - easy, repeatable sample loading up to 400 PSI (2.76 MPa)
- ✓ Rapidly characterize samples over wide temperature & RH
- ✓ Robust method - accurate, repeatable & reliable
- ✓ Multiple alarms for safe operation

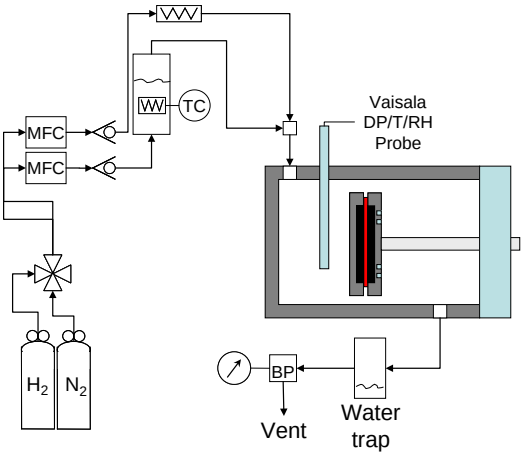


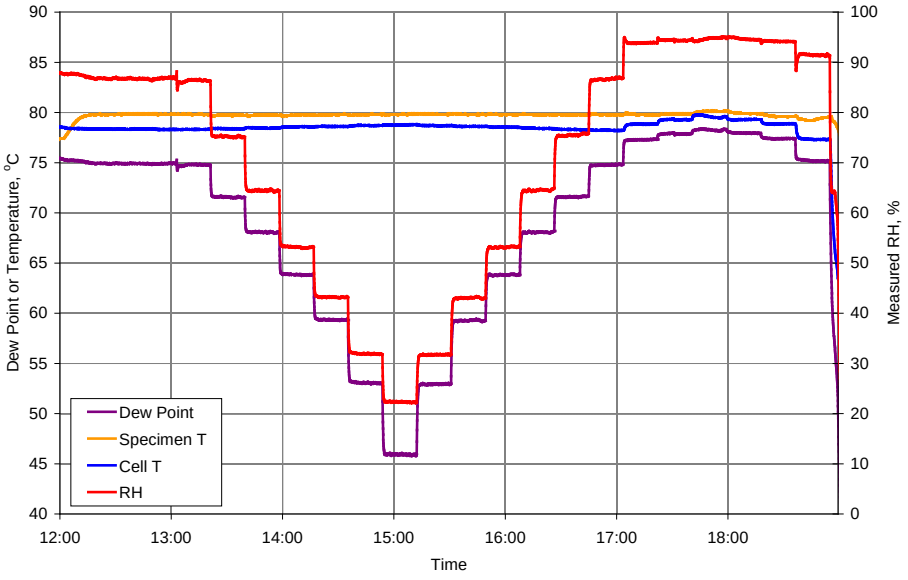


U.S. Patent No. 7,652,479

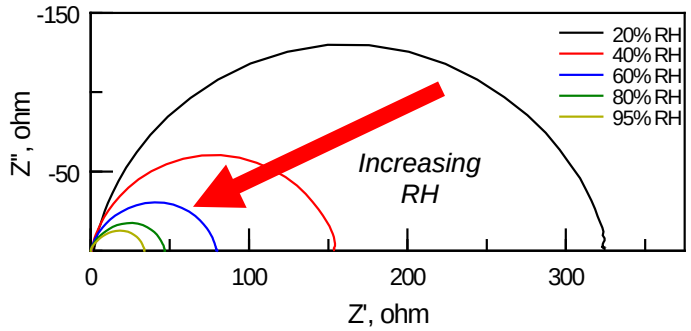
The MTS 740 uses wet-dry gas mixing for controlled, rapid RH cycling of sample environment

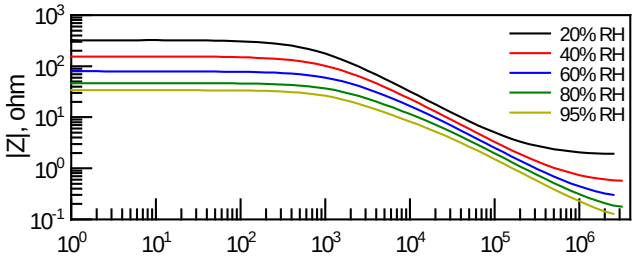
- ✓ Repeatable, reproducible and stable T & RH control → ±2% from 20% to 95% RH
- ✓ Rapid RH cycling for time-efficient testing over wide RH range
- ✓ Operating range: 30 °C to > 120 °C, 1 to 3 atmospheres

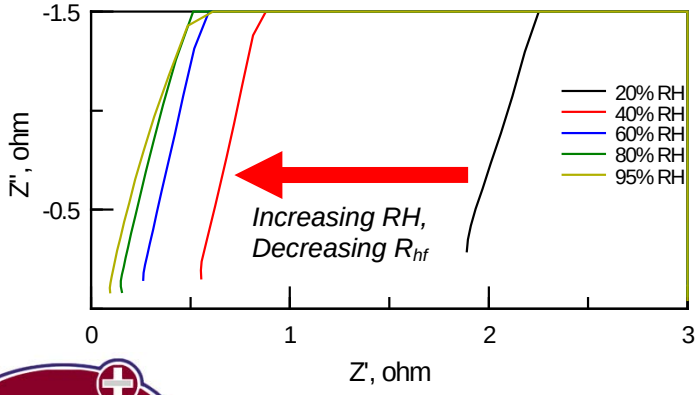


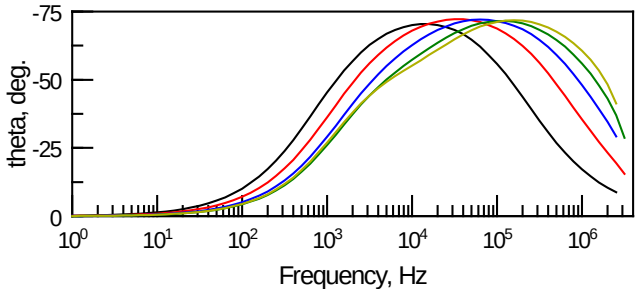


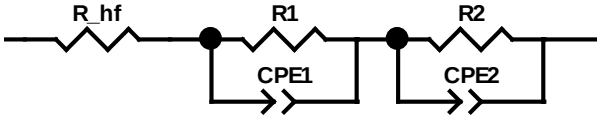
High frequency intercept & sample resistance obtained by fitting impedance spectra to an equivalent circuit model



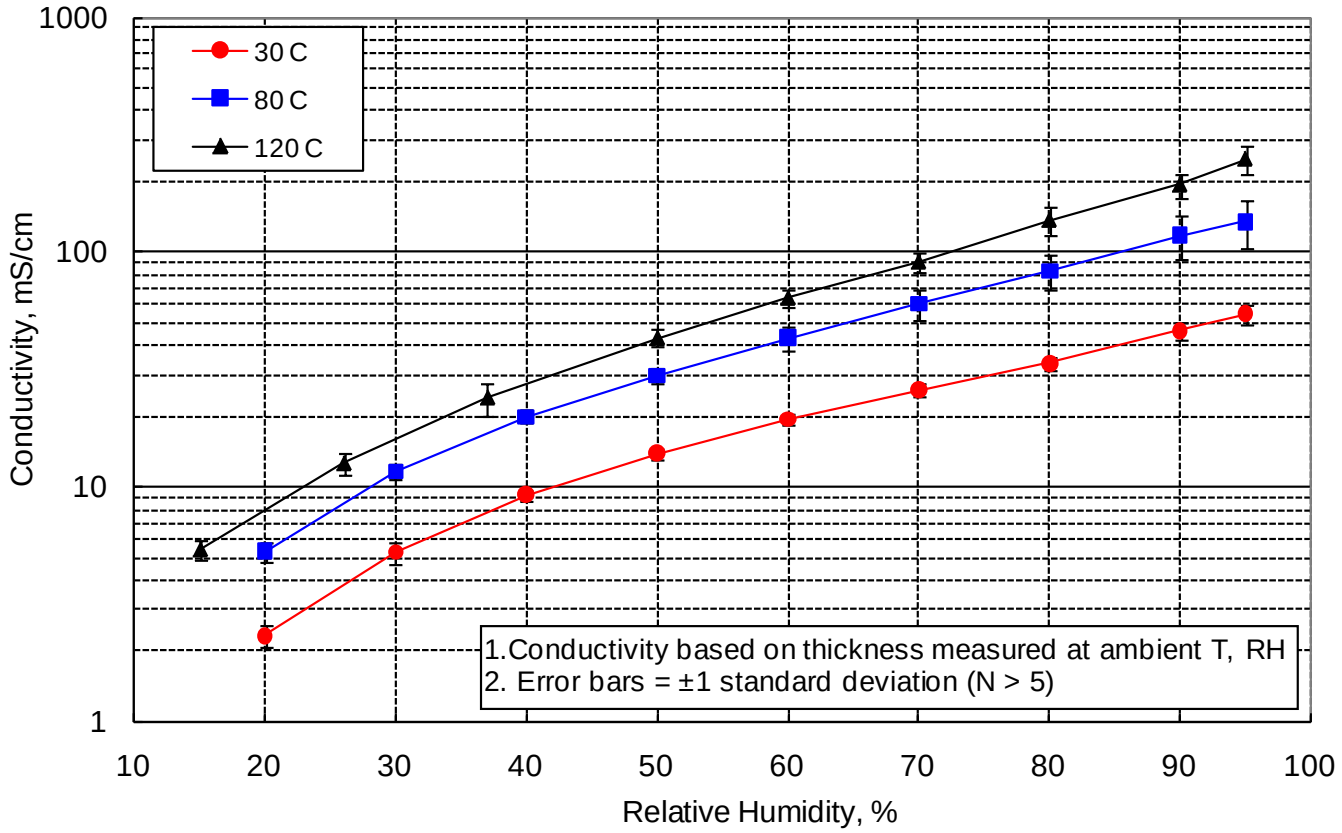








Through-Plane Conductivity of Nafion® NR-212



System Features

- Includes ***MTS4 Software*** for complete measurement process control and data acquisition
- Works with ZPlot® / ZView™ software for AC measurement of sample resistance
- Wet and dry gas mixing for accurate and precise RH control and rapid RH cycling
- Test chamber backpressure control, condenser and collection tank for high-temperature operation
- *In-situ* sample temperature and dewpoint measurement for real-time RH monitoring
- Control and monitoring of multiple process temperatures
- Rapid, easy cell assembly with accurate and repeatable sample compression
- Cell lock-feature for safe operation at elevated temperature, pressure and H_2 gas
- Automatic shutdown and N_2 purge on alarm condition
- Detailed cell assembly instructions and data analysis procedure
- Native USB interface to PC for easy set-up

Proven patented technology featured in
Journal of the Electrochemical Society **157**(11) B1731 2010

Specifications:

Sample Chamber Gas Control System:

Humidifier:	316LL SS material, designed for 100% gas saturation, auto water fill
Mass Flow Control:	Two; Wet and Dry, 0 - 500 sccm each (allows variable wet gas % and RH control)
Sample Gas Selector:	Selects N_2 or H_2/other
Gas Pressure Switches:	Two, H_2/other and N_2
Gas Dewpoint Meter:	One, capacitance-type sensor in sample chamber
Measurable Dewpoint:	0 to 100 ^{o}C
Set and Report Accuracy:	±0.25% of span, ±1 least significant digit
Set and Report Resolution:	0.1 ^{o}C
Sensor Type:	Thermocouples, Type T
Temperature (max)	150 ^{o}C (chamber and sample) 120 ^{o}C (humidifier) 130 ^{o}C (gas transfer line)

Sample Chamber:

Open/Close Mechanism:	Threaded, screw-in cell head with integrated electrodes
Electrode Clamp Mechanism:	Manual, spring-loaded, integrated with cell head
Electrodes:	Platinum, proprietary four-terminal design (U.S. Patent No. 7,652,479)
Temperature Range:	Ambient to 150 ^{o}C
Back Pressure Range:	Ambient to 30 PSIG (207 kPa)

Post-Chamber Gas Flow Path: Heat exchanger, condensate tank, precision backpressure regulator, vent port

Electrochemical Interface and Impedance Measurement:
User-supplied Impedance analyzer (Solartron Analytical 1260 FRA)
MTS4 software controls ZPlot®

Physical and Environment:

Operating Temperature:	15 - 35 ^{o}C
Power Source:	100-120 VAC; 50/60 Hz
Size (inches):	18H x 11W x 19D (excluding sample chamber top)

Software inputs for each experiment: Chamber, humidifier and gas transfer line temperature set point; Pre-treatment time (equilibration time); Total gas flow rate, Wet gas %, Gas type (H_2/other or N_2), and Back pressure (manually set).

Number of steps per experiment: Up to 100

Live Data Display: Sample temperature and dewpoint, RH value (calculated from dewpoint and sample temperature), Wet and dry gas mass flow rates, Measured impedance for a single frequency from ZPlot®, save ZPLOT to respective file types (when enabled), remaining step time.

Data File Format: Tab delimited ASCII file. Contains time, total flow, wet and dry flow, % wet, temperatures (dewpoint, sample, chamber, humidifier, gas transfer line), RH, pressure, gas type. ZPlot® impedance data saved as standard *.z file compatible with ZView™

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