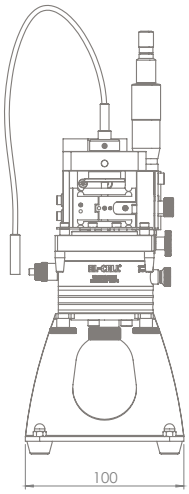
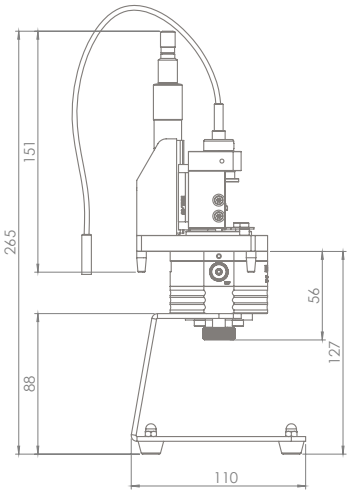
Measurements in mm:





ECD-3-nano

Test cell for the measurement of height changes with nanometer resolution

The ECD-3-nano is the dilatometer with a displacement resolution in the nanometer range. The capacitive parallel-plate sensor system of the ECD-3-nano can obtain displacement signals of below 5 nanometers. This high resolution makes it possible to explore new territory of electrochemical dilatometry. For instance, quasi 2-dimensional electrode processes like the SEI formation in lithium-ion batteries or the electrochemically driven growth of passivation layers on metal surfaces might become the subject of future dilatometric studies.

The heart of the ECD-3-nano is an electrochemical cell, which is hermetically tight against ambient atmosphere. The two electrodes inside are separated by a stiff glass frit that is fixed in position. The upper (working) electrode is sealed by means of a thin metal membrane through which any charge-induced height change is transmitted towards the sensor/load unit above.

Key Features

- Displacement resolution ≤5 nanometer
- Displacement range: 250 µm
- Compatible with aprotic as well as aqueous electrochemistry

Use Cases:

- 2- and 3-electrode setup
- Measurement of electrode strain (thickness change)
- Aprotic and aqueous electrolytes

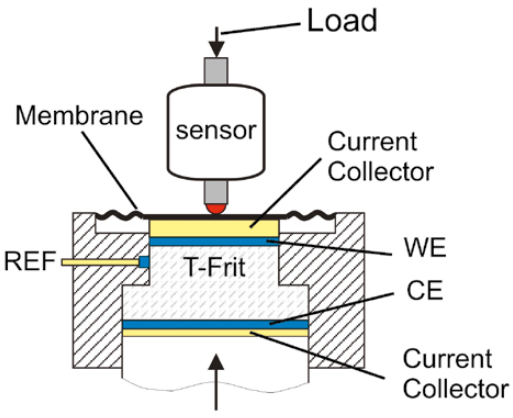
Product website:

Manual (PDF):

EL-Cell GmbH Tempowerkring 8 21079 Hamburg, Germany +49 (0) 40 79012 737 sales@el-cell.com el-cell.com

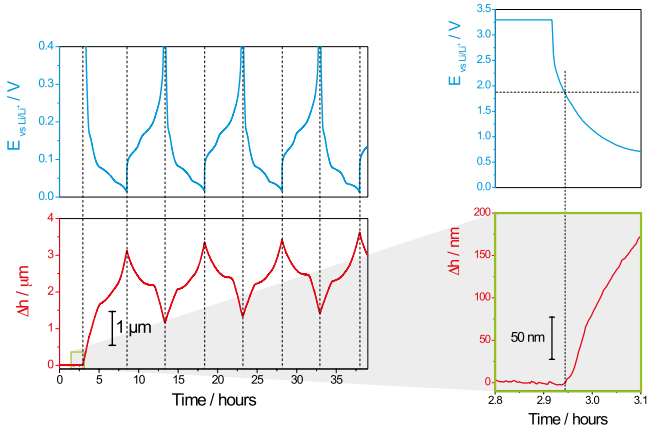
Specifications	
Height	265 mm
Width	100 mm
Depth	110 mm
Weight	2.5 kg
Separator diameter	12 mm
Working (upper) electrode diameter	10 mm
Counter (lower) electrode diameter	12 mm
Displacement sensor system	Capacitive
Displacement range	250 µm
Displacement resolution	≤ 5 nm
Signal drift (sample-free)	≤ 20 nm / hour
Test specimen	Electrode films, optional single crystals / grains (Diameter ≤ 10 mm, thickness ≤ 1 mm)
Load on test specimen	approx. 1 N
Chemical compatibility	Aprotic organic electrolytes; optional aqueous electrolytes
Cell electrolyte volume	approx. 0.5 ml
Operational temperature range (Cell and Sensor)	-20 to +70 °C
Operational temperature range (Conditioning electronics and data logger)	0 to +40 °C

Working principle



The working electrode (WE) and the counter electrode (CE) are separated by a stiff glass frit soaked with electrolyte. The upper WE is sealed by means of a flexible metal membrane, through which any charge-induced thickness change is transmitted towards the sensor/load unit attached on top. The fixation of the glass frit ensures that only the thickness change of the working electrode is being detected without interference from the CE. Optionally, a reference electrode REF can be placed at the edge of the frit close to the working electrode.

Sample test result



Expanding and shrinking of a graphite electrode during lithium insertion and extraction (figure left). The detailed view on the right shows the onset of expansion at 1.9V vs. Li / Li+ (figure right)