ASYLUM RESEARCH
Atomic Force Microscopes

EC Cell

DATA SHEET 36

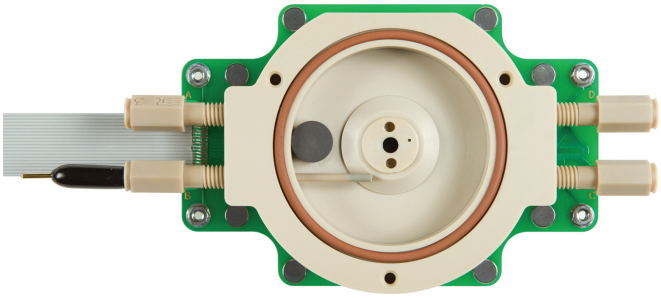
Electrochemistry Cell for the MFP-3D™ Atomic Force Microscopes

The electrochemistry cell (EC Cell) for the Asylum Research MFP-3D Atomic Force Microscopes enables studies of deposition, oxidation, corrosion, and mass transfer of metals and other materials. Nanoscale topographical changes can be precisely monitored in situ as induced by electrochemical reactions. The cell provides for heating from ambient to 60°C (optional) and can be operated in a fully sealed configuration.

The EC Cell is a versatile platform for electrochemical experiments combined with AFM imaging. At the core of the device is a PEEK™ container with ports for fluid exchange and electrical feedthroughs. A variety of electrodes is supplied with the EC cell, yet the design is extremely adaptable to accept customized sample mounts or electrodes.

All parts of the EC Cell which come into contact with the electrolyte are made of PEEK polymer. Supplied O-rings are made of FKM (Viton® equivalent) in industry-standard sizes; additional O-rings made of Kalrez® or Teflon® may be purchased separately. The specialized cantilever holder included in the kit is designed such that only the PEEK body and a small quartz window make contact with the electrolyte, avoiding contamination of the cell's contents.

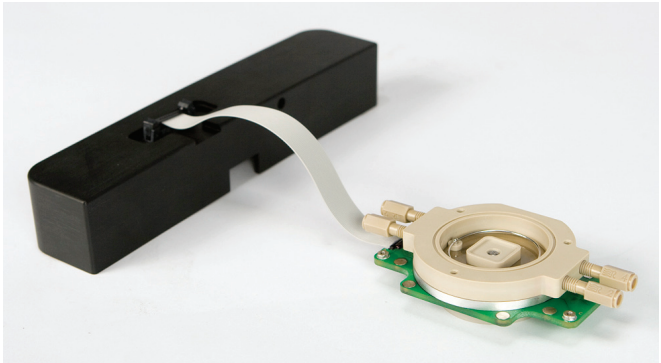
The EC Cell is supplied with a variety of sample mounts which can be removed for cleaning or polishing. Sample mounts are supplied for press fitting or epoxy potting various electrode materials.



Asylum research can assist with any specialized sample mounting needs.

The EC Cell is easily disassembled for cleaning and samples can be readily removed for cleaning or polishing. The cell's fluid ports enable straightforward exchange of electrolyte.

The kit includes a graphite counter electrode as standard. A platinum counter electrode is available (optional). Metal wires of up to 1/16" diameter can be fed into the cell through two side access ports. Teflon tubing with a variety of inner diameters is supplied to seal around smaller diameter



The EC Cell with heater plate, providing heating from ambient to 60˚C. The heater allows, for example, studies of electrolytes which are not liquids at room temperature.

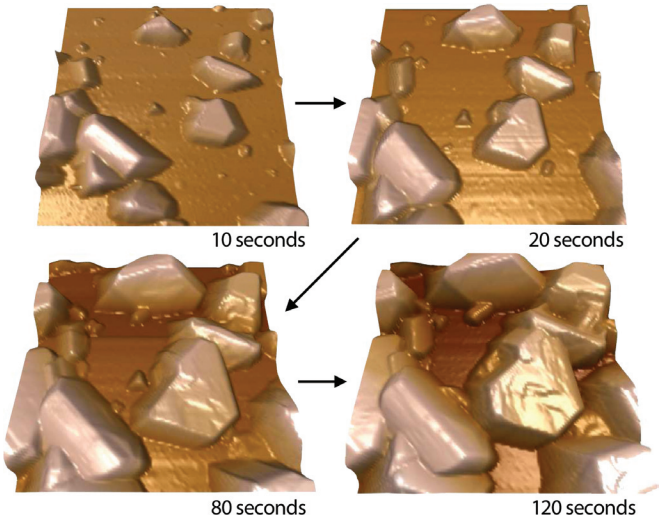
wires. The wires are easily connected at any of four places on the outside of the EC Cell body.

All electrodes are connected to a built-in circuit board which routes signals to a junction box. The junction box attaches securely to the AFM base and offers connection to third-party potentiostats via standard banana-plug or 2mm connectors. This arrangement keeps cables and clips/connectors away from the sample, making for a tidy experiment with minimal chance of short circuits, and avoiding disturbance of the sample by eliminating cable movement. The junction box can also be connected to the MFP-3D Environmental Controller to drive the electrolyte heater. An optional heating element enables the investigation of thermodynamics and kinetics of electrochemical reactions, such as the temperature dependence of:

- electrochemical parameters such as pKa
- acceleration of corrosion
- protein/enzyme turnover rates

The EC Cell Kit Includes

- EC Cell with volume reducing insert
- A variety of sample mounts
- Specialized all-PEEK cantilever holder
- Fully-sealed, liquid-filled Ag-AgCl reference electrode with PEEK barrel.
- Carbon Counter Electrode
- Optional Platinum Counter Electrode
- Junction box facilitating connections between the cell and any third-party potentiostat
- Two fluid ports
- Two fluid or wire feedthrough ports
- Tubing, connectors, and various fittings
- FKM membrane for sealed operation.
- Optional electrolyte heater



In-situ AFM images of bismuth electrochemical deposition on a boron doped diamond electrode performed using the Asylum Research MFP-3D AFM and Electrochemical Cell (10s, 20s, 80s and 120s reaction times). 1.5µm scan. Note the same position is scanned each time showing the bismuth crystals growing in size. Sample courtesy of Professor R. Compton, Oxford University.

Acknowledgement

The EC Cell was developed in collaboration with the research group of Prof. Richard Compton of the Chemistry Department at the University of Oxford, UK. (See references below)

References

1. K.E. Toghill, L. Xiao, M.A. Phillips, R.G. Compton, The non-enzymatic determination of glucose using an electrolytically fabricated nickel microparticle modified boron-doped diamond electrode or nickel foil electrode, *Sensors and Actuators B,* **147**, 64 (2010).

2. N.R. Stradiotto, K.E. Toghill, L. Xiao, A. Moshar, R.G. Compton, The Fabrication and Characterization of a Nickel Nanoparticle Modified Boron Doped Diamond Electrode for Electrocatalysis of Primary Alcohol Oxidation, *Electroanalysis,* **21**, 2627 (2009).

3. K.E. Toghill, G.G. Wildgoose, A. Moshar, C. Mulcahy, R.G. Compton, The fabrication and characterization of a bismuth nanoparticle modified boron doped diamond electrode and its application to the simultaneous determination of cadmium(II) and lead(II), *Electroanalysis,* **20**, 1731 (2008).

ASYLUM RESEARCH

6310 Hollister Ave.
Santa Barbara, CA
93117

voice: 805-696-6466
fax: 805-696-6444
toll free: 888-472-2795

www.AsylumResearch.com
sales@AsylumResearch.com