Instruction Sheet
PTC1 Paint Test Cell Kit

Product Description

The Gamry Instruments' PTC1 Paint Test Cell kit is a simple, inexpensive cell used for electrochemical corrosion testing. This cell was originally developed by Dr. Richard Granata of Lehigh University.

The PTC1 was designed for electrochemical impedance testing of flat, coated metal specimens. The PTC1 can also be used to test base metal samples using PortHole Electrochemical sample masks.

Initial Inspection

Check that your PTC1 Cell Kit contains the following parts.

1	930-00026	Cell Body, PTC1, w/o-ring
1	935-00035	Stopper, Rubber, PTC1
1	935-00036	Clamp, PTC1, Ace 7669-18
1	930-00003	Reference Electrode, SCE
1	935-00014	Graphite Rod, 8 mm x 6″
1	935-00039	Base, PTC1

Check that none of the parts have been damaged in shipping. If damage has occurred, contact Gamry Instruments or your local representative as soon as possible.

Assembly of the Cell Top

CAUTION: The reference and counter electrodes can break during this procedure. If you are not careful, a broken electrode can pierce your hand . These precautions are vital for your safety.

a. Always lubricate the reference electrode with water before inserting it into the top.

b. Grasp the electrode as near to the stopper as possible and twist the electrode as you are inserting it.

c. When inserting the electrodes, hold the stopper between your thumb and your first finger. Do not place your palm under the stopper.

d. Double check that you are inserting each electrode in its proper hole.

Assembly of the top is simple. Follow these simple instructions:

1. Locate the rubber stopper. Notice that the holes in the stopper have different diameters.
2. Gently push the graphite counter electrode into the smaller of the two holes in the top.
3. The counter electrode should be inserted until approximately 5 cm of the electrode extends below the top.
4. Wet the outside of the reference electrode with a few drops of water.
5. Gently push the reference electrode into the larger of the two holes in the top.
6. The reference electrode should be inserted until approximately 5 cm of the electrode extends below the top.

Metal Sample Requirements

If a rectangular metal sample is used it must measure at least 6 cm on each side. The sample must be flat enough that a water tight o-ring seal can be made.

The area to be tested must be within 2 cm of one of the edges on the sample. If it is farther away the clamp cannot hold the cell on the sample.

The minimum sample thickness depends on the type of metal, with 0.05 mm a useful guideline. Samples between 7 mm and 15 mm thick require testing without the base.

Painted samples must have an area outside of the cell free from paint. This area is used to make electrical contact with the sample.

Chemical Compatibility

The o-ring used in this cell is made from an ethylene/propylene elastomer. The top is made from a carbon filled natural rubber. These materials are not universally chemically resistant. They should give acceptable performance with dilute acids, bases and chloride salts.

We do not recommend use of the PTC1 with strong acids and bases, oxidizing or reducing agents, or organic solvents. Gamry Instruments is not responsible for damage caused to the cell, your laboratory, or your person by use of the PTC1 with an incompatible test solution.

Cell Setup

Thin samples are tested in a setup that includes the PTC1 base, which is a polypropylene block equipped with 4 rubber feet. The sample is placed on the side of the base without the feet.

The cell body is then placed on top of the sample, making sure that the o-ring fits in the groove on the cell body. This o-ring makes a watertight seal between the cell body and the sample.

The clamp is then used to clamp the glass to the base. The knurled knob on the cell clamp should always be used - it compresses the o-ring.

Once the cell has been tightly clamped into place on the metal sample, it can be filled with the test solution. Approximately 40 ml of solution are required.

The top, with the reference and counter electrode already in place, is then placed on the cell. Make sure that the protective cap has been removed from the reference electrode. With the top lightly pressed into the cell body, you should get a watertight seal.

Before making the connections to the test instrument, it's a good idea to check that the cell isn't leaking from the o-ring seal. Once you are sure the cell isn't leaking, you can connect the test instrument. The metal sample is used as the working electrode.

Working Electrode Area

The area of the sample exposed to the test solution varies somewhat due to variation in the compression in the o-ring and variation in the glass cell body. We have measured the active area to be nominally 14.6 cm2. At worst, the real area should be within ±5% of this value.

Replacement Parts

With the exception of the o-ring, all of the part numbers for replacement parts can be found in the table near the top of this document. The cell body includes an o-ring. O-rings can also be ordered separately using P/N 935-00037 which is a package of 5 o-rings.

Reference Electrode Maintenance

It is generally best if both electrodes are left in the cell top when the cell is not in use. The small protective cap shipped with the reference can be used to cover the electrode tip if you want to store the top dry. Many chemists believe that reference electrodes should be stored immersed in solution. If you wish to do so, the top can be placed on top of a beaker containing distilled water or KCl.

The tubing over the breather hole in the side of the electrode should be moved to allow a small opening whenever the electrode is in use. After a long period of use, you may need to add KCl crystals to the reference filling solution or replace the filling solution entirely.

PortHoles™

Electrochemical Sample Masks

PortHoles Electrochemical Sample Masks define a specified area of a flat metal sample for electrochemical testing with the PTC1. PortHoles are available in 1, 3, or 10 cm^2 area to accommodate any specimen. PortHoles are fabricated from 3M Model 470 Electroplater's Tape.

Before applying the PortHole, degrease the surface using a suitable solvent. Remove the backing from the PortHole and place it carefully on the metal sample. Roll the PortHole over the metal sample to make sure that the tape does not crimp around the perimeter of the hole.

Carefully press down on the entire surface of the PortHole. Pay special attention to the perimeter of the hole – it is important to get good adhesion on the perimeter to minimize the possibility of crevice corrosion. Use a spatula or a round implement to press the edge of the tape firmly against the metal sample.

Place the cell body and O-ring of the PTC1 on the PortHole so that the exposed area of the sample is enclosed. Clamp the cell body firmly as described above and proceed normally.

When the experiment is complete, remove the PortHole and discard. If the sample-electrolyte system tends to undergo crevice corrosion, visually examine the periphery of the hole with a magnifier. If any crevice corrosion is detected, the data for that sample should be discarded.

If crevicing is particularly prevalent with any sample, consider the following approach. Place the sample in a benign electrolyte and apply +0.75 volts for 60 seconds to form an oxide film. Remove the sample from the electrolyte and dry it. Place a PortHole in position on the sample. Manually remove the oxide film from the area exposed by the PortHole using a fine emery cloth or a pencil eraser. Perform the electrochemical experiment.

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