EL-CELL®
electrochemical test equipment

User Manual

Release 1.21

ECC-Opto-10

Electrochemical test cell

The information in this manual has been carefully checked and believed to be accurate; however, no responsibility is assumed for inaccuracies.

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1 Product Description

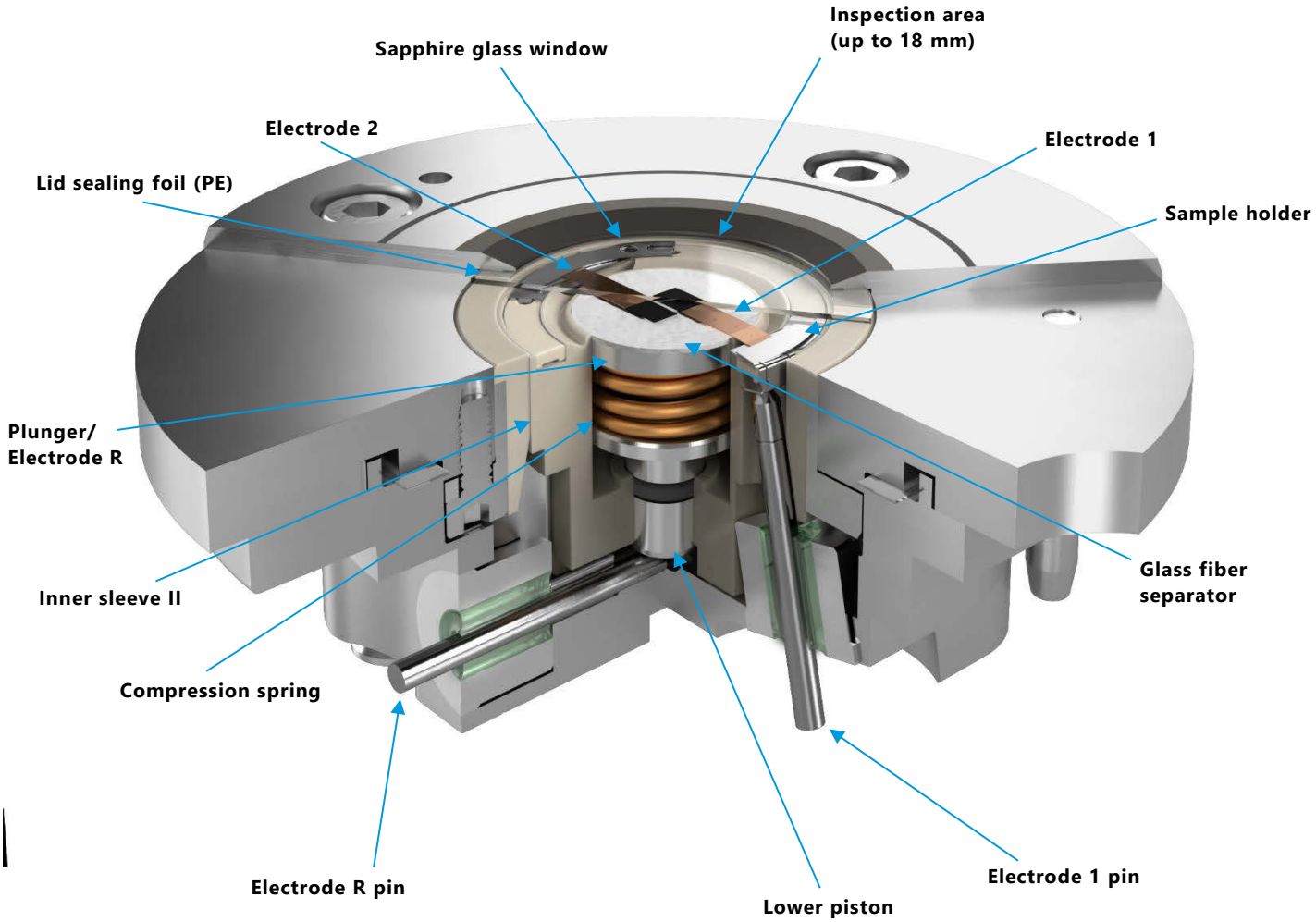
The ECC-Opto-10 test cell is designed for the operando characterization of electrodes using optical methods such as light microscopy or Raman spectroscopy in reflection mode.

The ECC-Opto-10 is connected to the battery tester via a 2 mm cell cable with banana plugs. It can be used with the PAT-Tester-x-8 as well as potentiostats and battery testers from third-party manufacturers.

Features

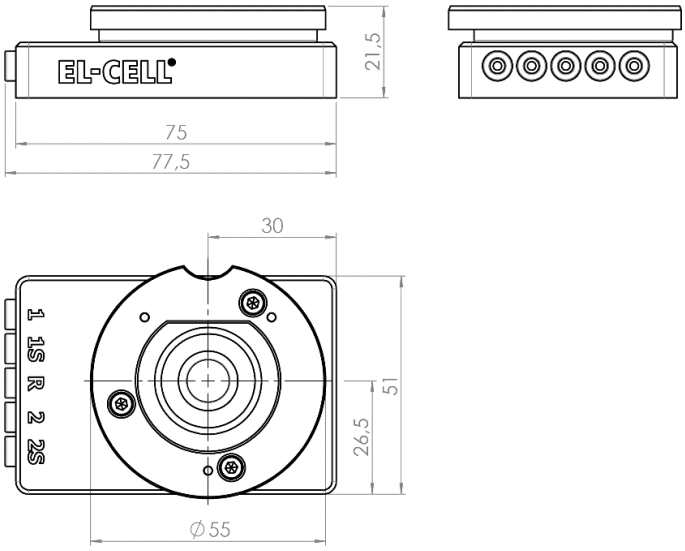
- 2- and 3-electrode cell with optical window for aprotic electrochemistry
- High cycling stability due to glass-to-metal seals
- Suited for light microscopy and Raman spectroscopy
- Fits on standard microscope sample stages (76 × 26 mm (DIN ISO 8037-1))

Working principle of the ECC-Opto-10 (side-by-side setup of electrodes):



2 Technical data

- Length: 77.5 mm
- Width: 51 mm
- Height: 21.5 mm
- Weight: 0.3 kg
- Temperature resistance: -20 to 70°C
- Electrode R diameter: <= 10 mm
- Dead volume: 1.8 cm^3



3 Intended use

The ECC-Opto-10 test cell is an electrochemical measuring instrument designed for use in a laboratory environment. It may only be used by trained personnel and only as described in this manual.

4 Safety Precautions

Use proper safety precautions when using hazardous electrode materials and electrolytes. Wear protective glasses and gloves to protect you against electrolytes that may accidentally spill out during filling and disassembly. Upon cell disassembly, dispose of all materials properly. Metallic lithium and some insertion compounds may decompose heavily in contact with water and other solvents and can cause a fire.

5 Assembly

Please note: All assembly steps are to be carried out in an inert glove box atmosphere. All components used are to be dried upfront in a vacuum oven at 80°C (120°C for parts made of PPS) for at least 12 hours.

Once fully assembled, the cell is hermetically sealed so that it may be operated in an ambient atmosphere.

The test cell can be used in several different configurations, which mainly differ in the type and size of the working electrode used, the charging geometry (the position of the working and counter electrode relative to each other), and the connection to the potentiostat (2- or 3-electrode connection). In the following, the cell assembly is described in several parts.

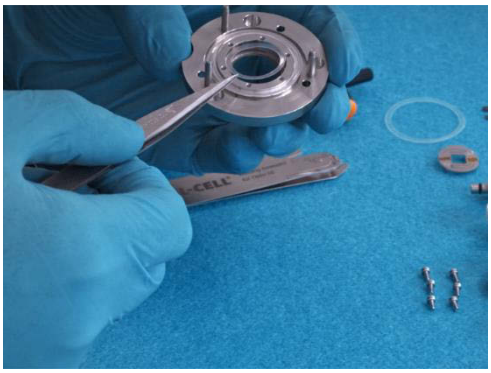
5.1. Lid assembly

5.2. Instructions for assembling the cell for the side-by-side arrangement of electrodes.

5.3. Instructions for assembling the cell for the face-to-face arrangement of electrodes.

These instructions can also be viewed as videos on our website el-cell.com.

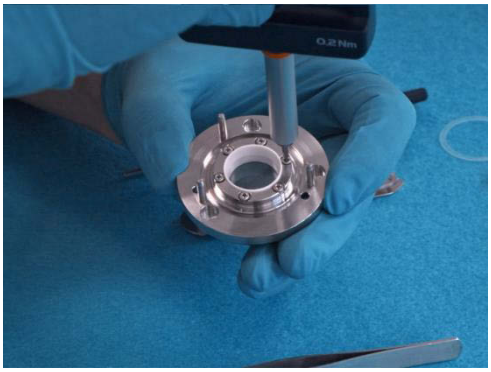
5.1 Lid assembly:



1. Turn the lid upside down. Insert the foil sealing into the lid.

2. Insert the window.

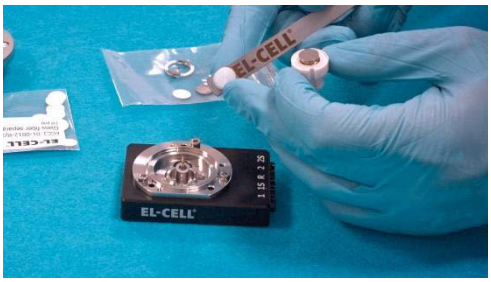
3. Insert the window thrust ring.



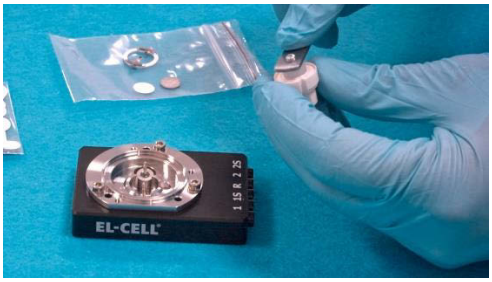
4. Attach the window flange and screw in the screws using the torque screwdriver 0.2 Nm.

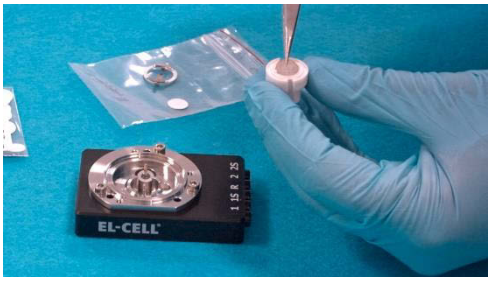
5.2 Assembling the cell with a side-by-side sample holder:

1. Assemble the lid as described above. Then attach the electrode strips to the sample holder.

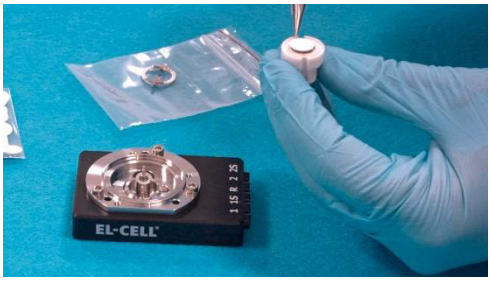


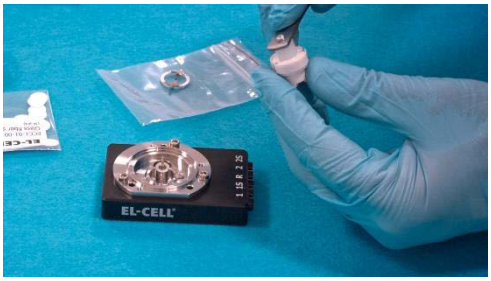
2. Use the loading tweezer to push the piston into the sleeve.





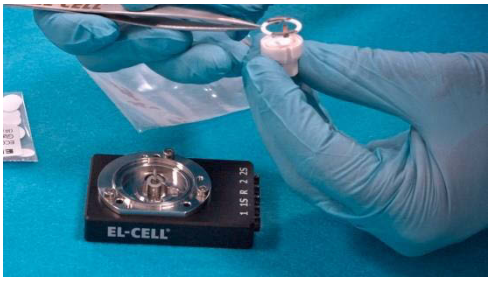
3. Put the electrode R, lithium metal in this case, on top of the piston.



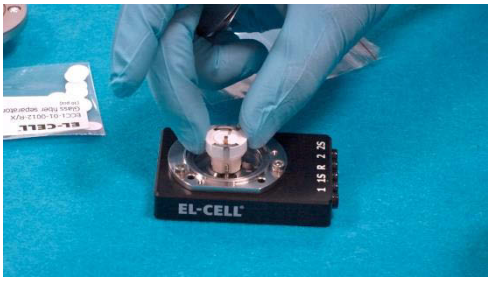


4. Put the separator on top and push it down using the loading tweezer.

The separator must not be more than 10 mm in diameter. A smaller separator may be useful to prevent the sample holder from coming into contact with the electrolyte.

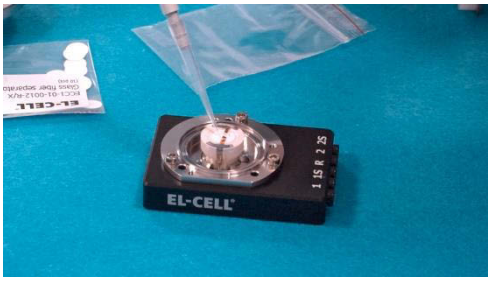


5. Attach the sample holder and press it down.



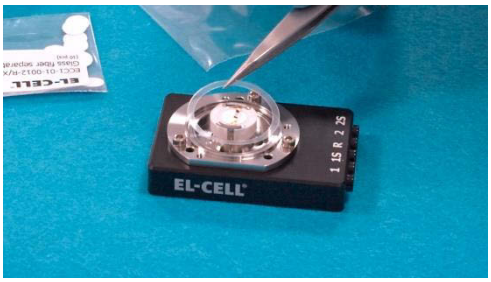
6. Insert the assembly into the cell base.

7. Make sure that the electrode strips are properly aligned before attaching the lid.

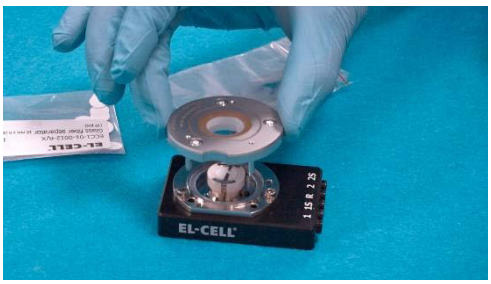


8. Drop the electrolyte onto the separator/electrodes. Use only the amount of electrolyte necessary to impregnate the porous material. Avoid excess electrolyte. Typically, around 30 µl of electrolyte is suitable.

Note that electrolyte will be squeezed out of the separator when the cell lid is attached.



9. Insert the PE foil seal.



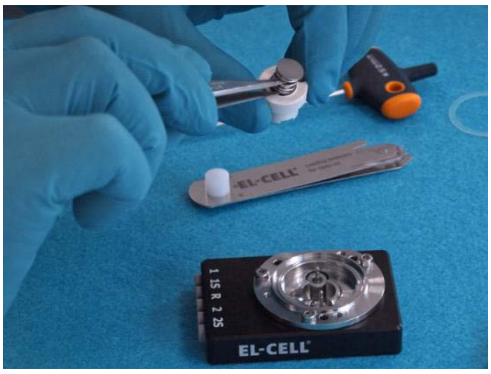
10. Put on the cell lid. Make sure that the flat side of the cell base and the straight line on the lid are parallel.

11. Doublecheck the proper alignment of the electrode strips.

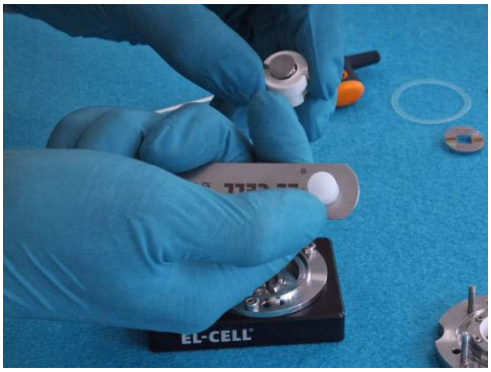
Then press down the lid and tighten the three screws firmly with the 2.5 mm hexagon screwdriver.

12. The ECC-Opto-10 is now ready for testing. It can now be removed from the glove box.

5.3 Assembling the cell with a face-to-face sample holder:

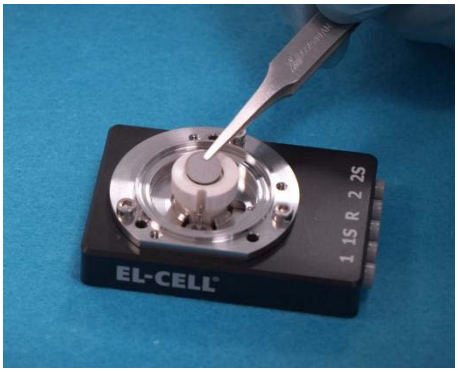


1. Follow the lid assembly steps. Then insert the lower piston into the inner sleeve.

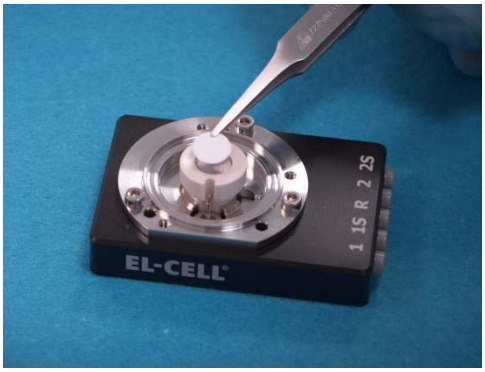


2. Use the loading tweezer to push the piston into the sleeve.

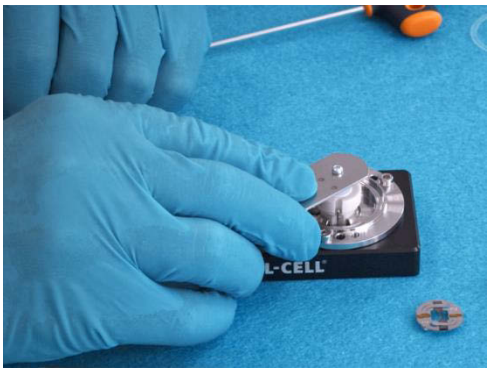
3. Place the assembly into the cell base.



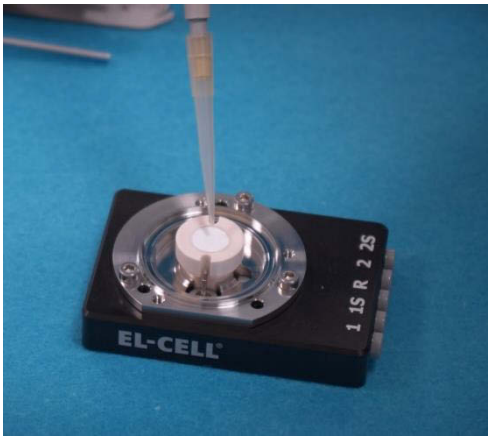
4. Put the electrode R, lithium metal in this case, on top of the piston.



5. Put the separator on top. The separator must not be more than 10 mm in diameter. A smaller separator may be useful to prevent the sample holder from coming into contact with the electrolyte.

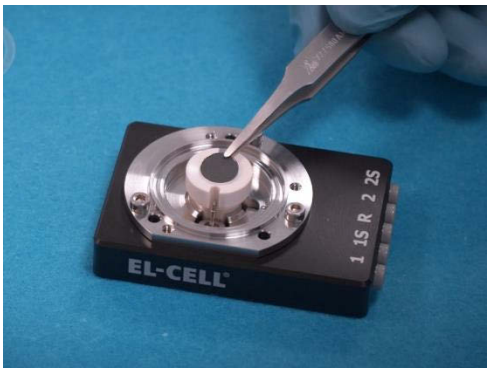


6. Use the loading tweezer again to push the cell stack further down.

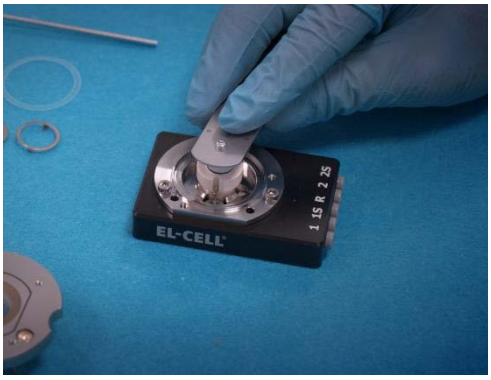


7. Drop the electrolyte onto the separator. Use only the amount of electrolyte necessary to impregnate the porous material. Avoid excess electrolyte. Typically, less than 50 µl of electrolyte is suitable.

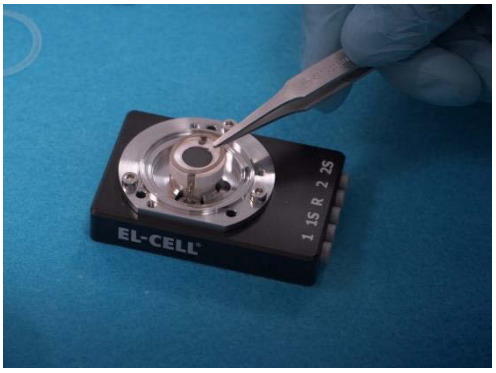
Note that electrolyte will be squeezed out of the separator when the cell lid is attached.



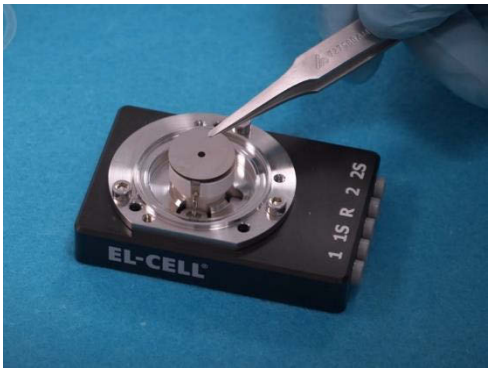
8. Put the self-standing electrode on top. If the electrode has a grid-like current collector, the grid must point downward toward the separator.



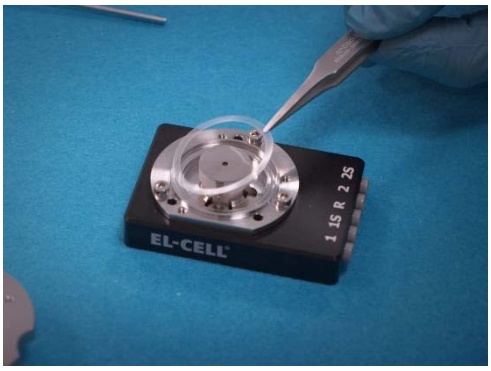
9. Push down the electrode stack using the loading tweezer.



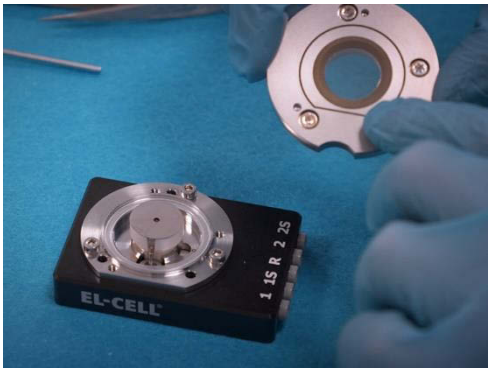
10. Insert the contact ring.



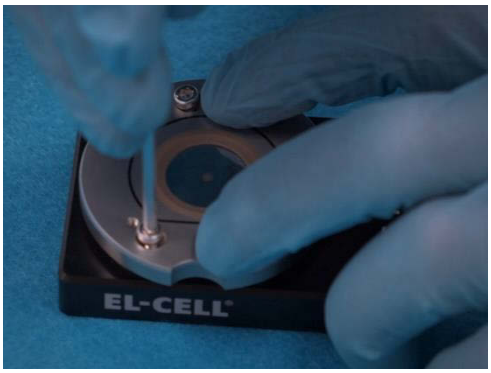
11. Put the holed current collector on top. Choose the hole size depending on the magnification used by the microscope.



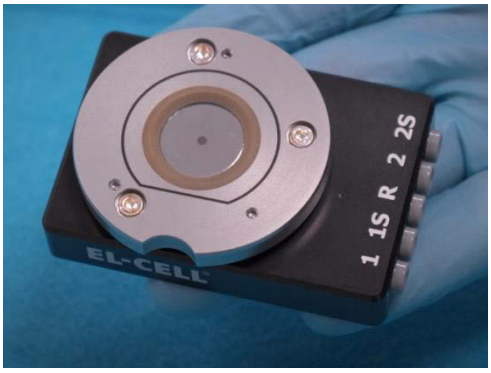
12. Insert the second foil seal.



13. Put on the cell lid. Make sure that the flat side of the cell base and the straight line on the lid are parallel.



14. Finally, screw the cover on with the 2.5 mm hexagon screwdriver.



15. The ECC-Opto-10 is now ready for testing.

6 Connecting the test cell

Connect your potentiostat to the 2 mm sockets of the cell. Note that sockets 1 and 1S are short-circuited inside the cell housing, as are sockets 2 and 2S.

7 Disassembly and Cleaning

Right after use, disassemble the cell in the reverse order of assembly. All chemicals used have to be disposed of properly. All wetted parts are to be cleaned with water and/or other appropriate solvents. All parts are to be dried immediately after cleaning at 80°C. All cell parts made of PPS are to be dried immediately after cleaning overnight at 120°C.

NOTE: Leaving cell parts in contact with the ambient atmosphere while still being wetted with electrolyte may result in severe corrosion.

8 Unpacking

Check the contents of the packages against the list given below to verify that you have received all of the components. Contact the factory if anything is missing or damaged.

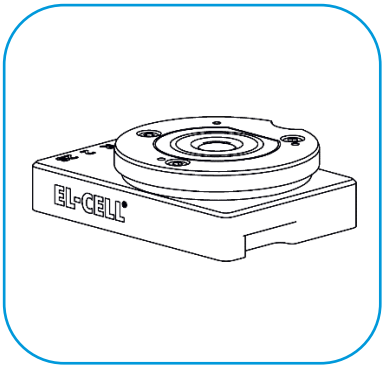
NOTE: Damaged shipments must remain with the original packaging for freight company inspection.

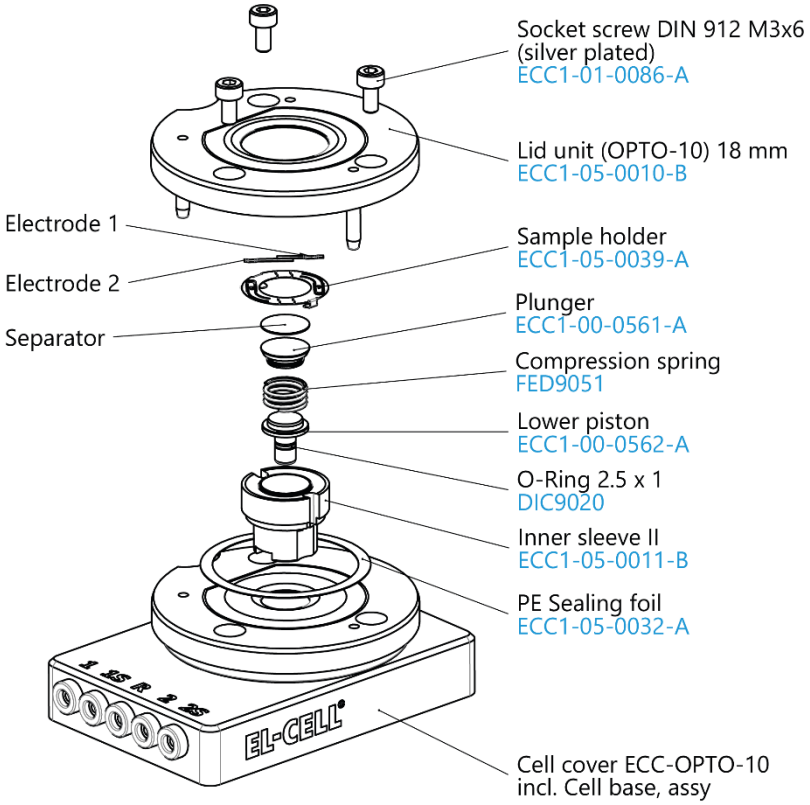
List of Components:

1. **ECC-Opto-10** test cell with flat socket, fully equipped for use in both 2-electrode and 3-electrode configuration
2. **Windows seal (10 pcs.)** ECC1-05-0016-B/X
3. **Separator 10.0 mm x 0.26 mm, GF/A (10 pcs.)** ECC1-01-0012-R/X
4. **PE Sealing foil (10 pcs.)** ECC1-05-0032-A/X
5. **Loading tweezer** ECC1-09-2010-B
6. **Torque screwdriver, 0.2 Nm, cross handle** WZG9021
7. **Inbus bit 1.5 mm x ¼ inch** WZG9046
8. **Hexagon screwdriver 2.5 mm, cross handle** WZG9047
9. **Sample holder (side-by-side)** ECC1-05-0039-A
10. **Contact ring (face-to-face)** ECC1-05-0039-C
11. **Contact disc (50 fold)** ECC1-05-0042-C
12. **Contact disc (100 fold)** ECC1-05-0042-A
13. **Contact disc (200 fold)** ECC1-05-0042-B

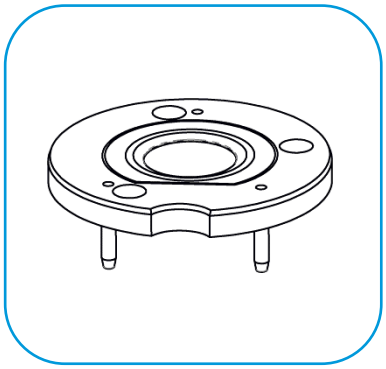
9 Components ECC-Opto-10

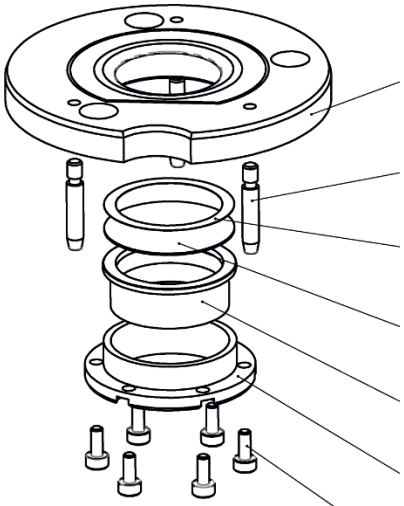
ECC-Opto-10





Lid (OPTO-10) 18 mm, assy





Lid (OPTO-10) 18 mm
ECC1-05-0029-C

Guide pin
ECC1-05-0037-A

Window seal
ECC1-05-0016-B

ECC-OPTO Sapphire window (0.3 mm)
ECC1-00-0149-A

Window thrust ring II (Opto-10)
ECC1-05-0012-C

Window flange II (OPTO-10)
ECC1-05-0013-B

Socket screw
DIN 912 M2 x 5

10 Technical Support

Technical support for this product is exclusively provided by EL-Cell GmbH.

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11 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defects in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. The buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at the Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is void when repairs are performed by a non-authorized person or service center. At the Seller's option, repairs or replacements will be made on-site or at the factory. If repairs or replacements are to be made at the factory, the Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed by the laws of Germany.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.