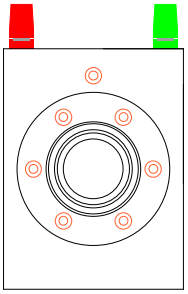
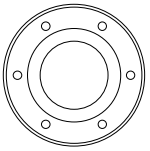
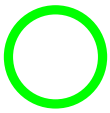
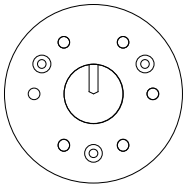
PECC

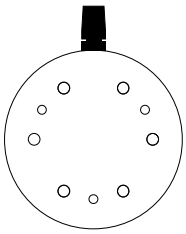
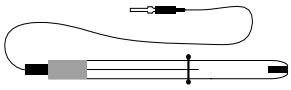
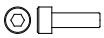
(Photoelectrochemical cell)

ZAHNER

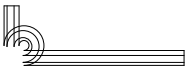
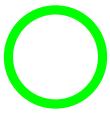
03/2023

1 PECC-1 – Photo-Electrochemical Cell Components

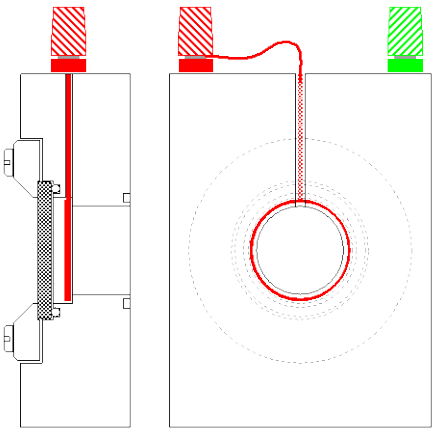
Position	*Count*	*Description*	*Drawing / Picture*
1	1	Cell body PTFE 80mmx60mmx25mm	
2	1	Flange PTFE diameter 60mm	
3	1	Window Diameter 31.6mm	
4	1	O-ring sealing 26x2	
5	1	O-ring sealing 22x2	
6	1	Specimen holder with basin PTFE Diameter 60mm Thickness 10mm	

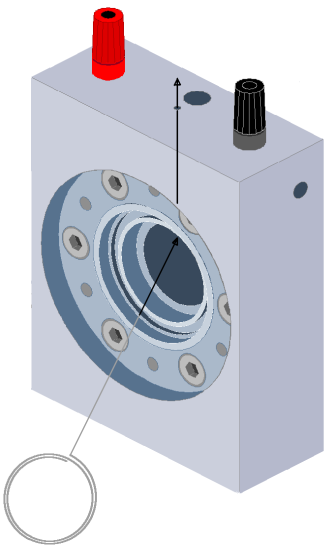
7	1	Working electrode holder with binding post Aluminium Diameter 60mm Thickness 8mm	
8	1	Platinum ring electrode	
9	1	Ag/AgCl reference electrode	
10	6	Bushing	
11	6	Allen screw M3x10	
12	6	Allen screw M3x25	
13	12	Shim	

PECC – tools & spare parts

Position	*Count*	*Description*	*Drawing / Picture*
14	1	Hex socket driver 1.5mm	
15	1	Hex socket driver 2.0mm	
16	1	Hex socket driver 2.5mm	
17	4	O-ring sealing 26x2	
18	4	O-ring sealing 22x2	

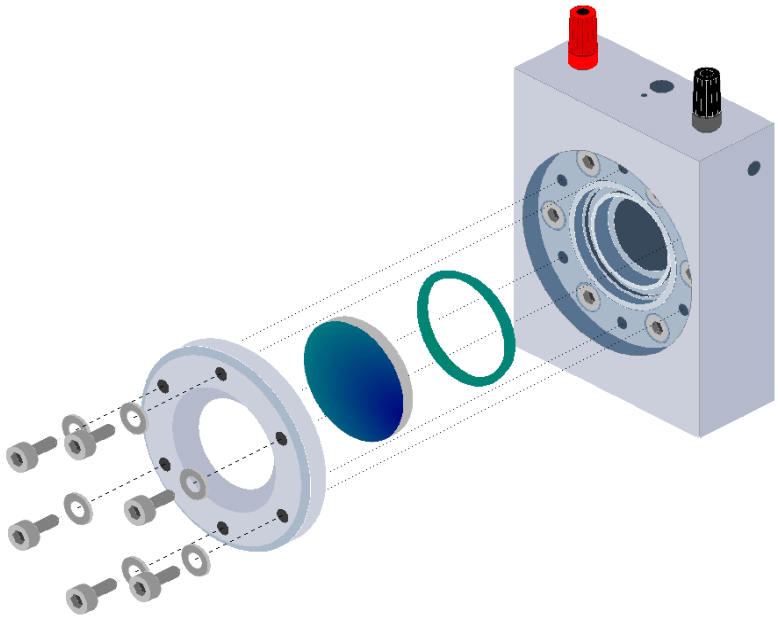
The counter electrode (CE)





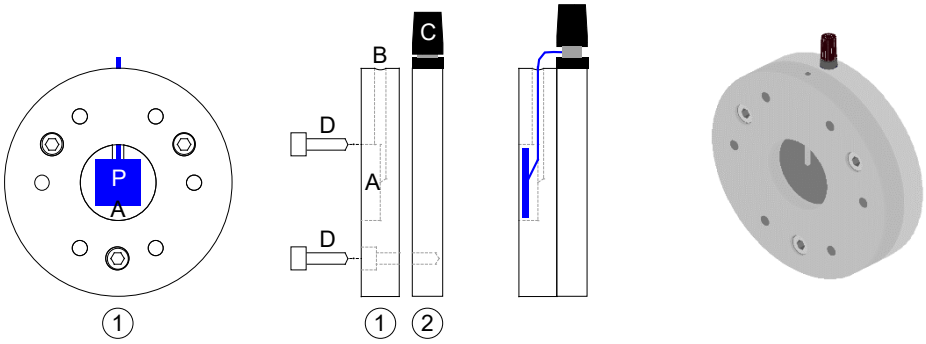
The Platinum counter electrode (CE) is located in the chamber behind the optical window. A 2 mm drilling hole leads the wire to the top of the cell body. The electrode will be fastened to the red connector.

The optical window



In order to mount the optical window place the green 26x2mm o-ring into the groove at the front of the cell. Place the window above the ring and fix the flange with 6 screws M3x12.

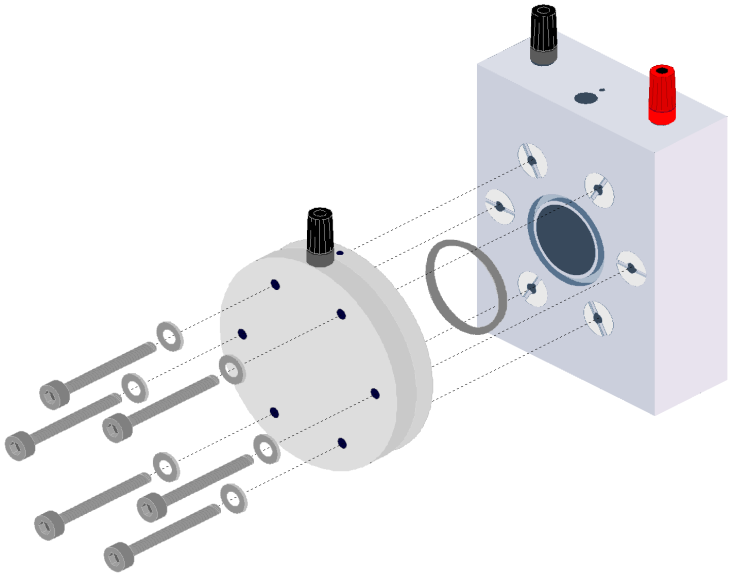
The working electrode assembly (WE)



The working electrode assembly consists of an insulating specimen holder (1, PTFE) and a conducting plate (2, Aluminium). The specimen holder and plate are fixed by 3 screws M3x10 (D). They can easily be screwed off for cleaning purposes. In this configuration, the required electrolyte volume is 7.9 cm^3 and the light path length in the electrolyte is 23 mm.

Place the specimen (P) in the small basin (A) in the middle of the specimen holder and lead the electric contact (wire) through the hole (B). Finally, contact the wire to the plate's black binding post (C).

The working electrode assembly will be mounted at the backside of the cell body using the black 22x2mm o-ring and 6 screws M3x25.

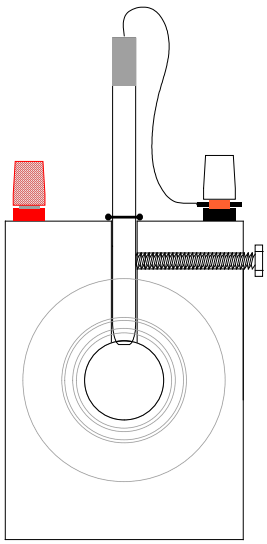


The WE assembly can be used also “inverted”, turned 180°”, if a metallic conducting sample under test with square or disk shape and dimensions between 25 mm and 34 mm length / 40 mm Ø is used. In this configuration, the required electrolyte volume is 6.3 cm^3 and the light path length in the electrolyte is 18 mm. The assembly screws are then ending at part 1, PTFE and the conducting plate part 2, Aluminium is then pressing the sample on the O-ring. When fastening the screws in this case, consider the softness of the PTFE material!

The wetted (active) specimen area is then ≈3.14 cm^2. The estimated ratio between the incoming light and light intensity on the sample is (in a non-absorbing aqueous medium) ≈3.16 so that an effective surface of 1 cm^2 can be assumed for photocurrent efficiency calculations. In non-aqueous media, specific absorption has to be considered (for instance Acetonitrile at 325 nm ≈18).

The reference electrode (RE)

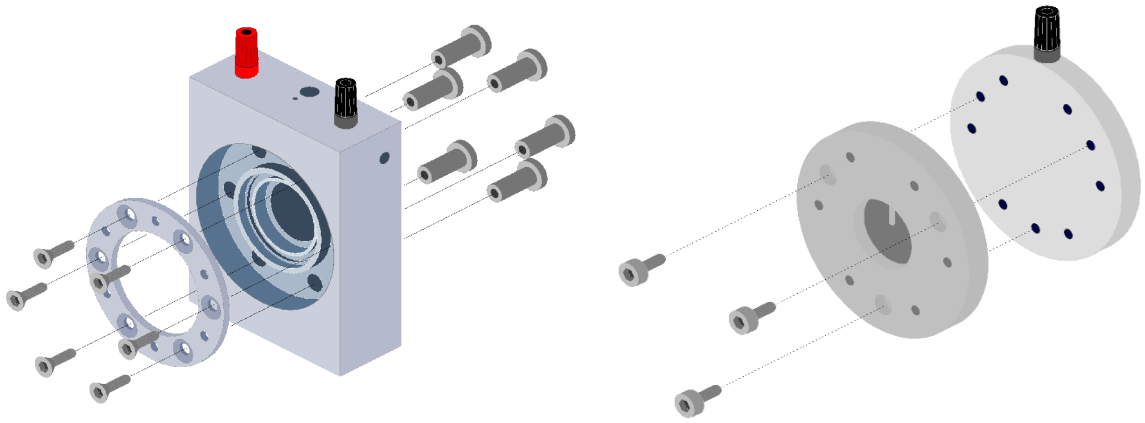
Place the Ag/AgCl reference electrode in the channel of 6 mm diameter located in the middle of the top of the cell body. Then either fix the depth by using the small o-ring or the plastic screw at the right of the cell. To connect the RE to the potentiostat the black binding post should be used.



Attention: When using the plastic screw to fix the reference electrode you should tighten it with very little force only. Tightening the screw too hard may damage the glass body of the RE.

Dismounting the PECC

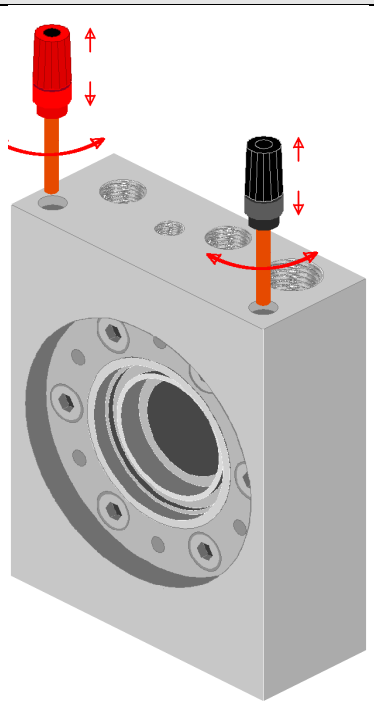
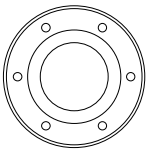
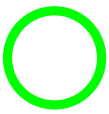
For cleaning purposes, the PECC can totally be dismounted.

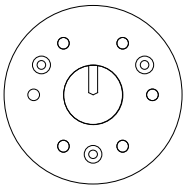
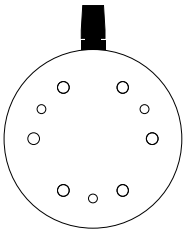
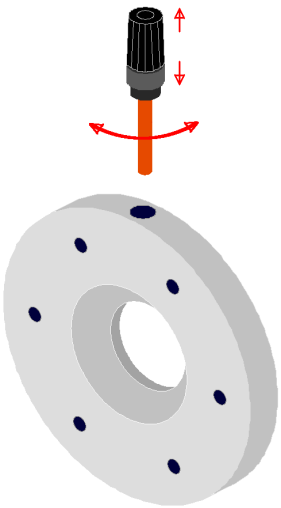


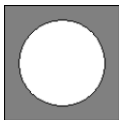
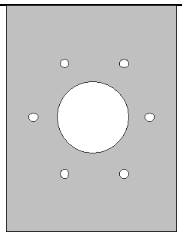
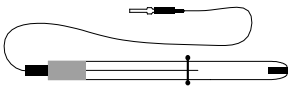
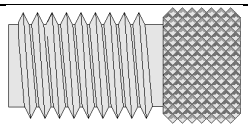
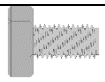
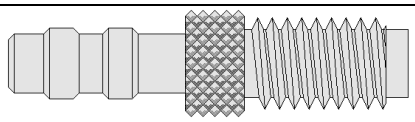
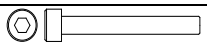
2 PECC-2 – Photoelectrochemical Cell Components

The optionally available PECC-2 differs from the PECC mainly in the following properties:

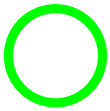
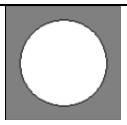
1. The cell body material is not PTFE, but PCTFE, which is harder and therefore enables more complex working structures.
2. The free diameter of the cylindrical electrolyte chamber is 18 mm in the case of the PECC-2 instead of 20 mm in the case of the PECC.
3. Gas inlet and gas outlet tubes and olives are foreseen for gas purging in order to enable for instance oxygen-free working.
4. The rear side of the PECC-2 is covered with a stainless steel sheet which acts as
    a.) contact material for the working electrode
    b.) EMI shielding
    c.) Transparent light blocker for absorbance measurement
5. The cell rear side aluminium mounting disk has a hole from the same diameter as the electrolyte chamber to act as a light entrance and transparent light outlet for absorbance measurements.
6. Counter electrode, reference electrode and gas inlet/outlet contain additional O-rings or rubber disks for gas tightening.
7. A syringe with a long, blunt truncated needle is recommended to ease the filling/emptying procedure without air bubbles. It is recommended to use the syringe because the electrolyte filling can be done more precisely and cleanly.

Position	*Count*	*Description*	*Drawing / Picture*
1	1	Cell body PTCFE 80 mm x 60 mm x 25 mm	
2	1	Flange PTFE Ø 60 mm	
3	1	BK7 / Quartz window Ø 31.6mm	
4	1	O-ring sealing glass window 26x2 mm	
5	1	O-ring sealing rear side 20x2 mm or 20x2.5 mm	
6	2	O-ring sealing for gas inlet/outlet 3,5x1 mm	

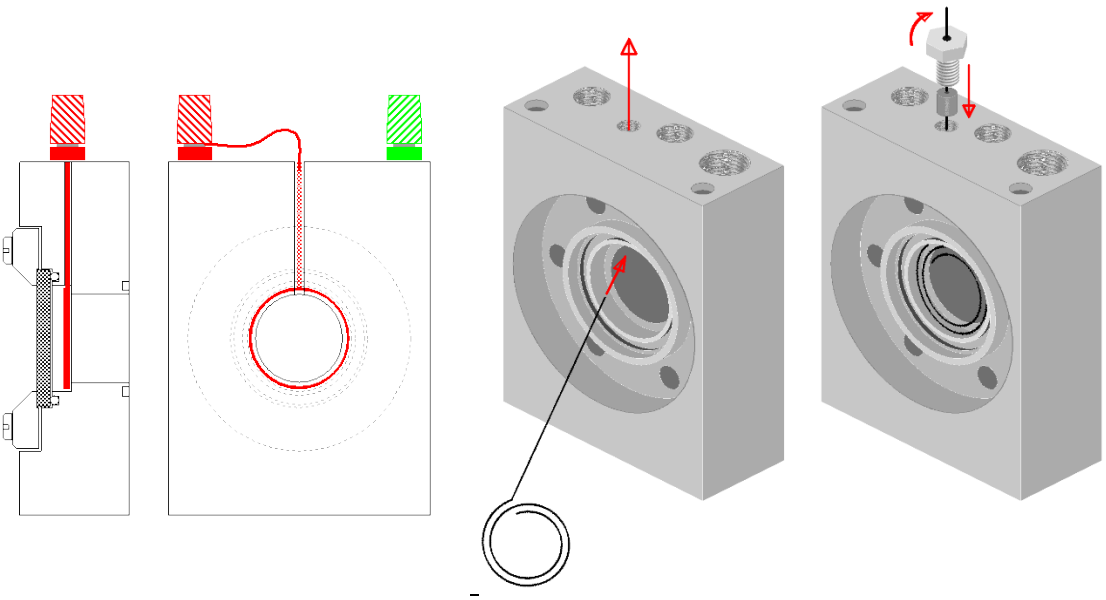
7	1	Rubber disk for counter electrode Ø4 mm	
8	1	O-ring sealing reference electrode 5,6x1mm	
9	1	Specimen holder with basin for small samples PTFE Ø 60 mm Thickness 10 mm	
10	1	Working electrode holder with binding post Aluminium Ø 60 mm Thickness 8 mm	
11	1	Working electrode holder with binding post and hole for rear side illumination or transmission measurement Aluminium Ø 60 mm, thickness 8 mm Please note, the working electrode itself is not included in the delivery. TCO-coated glass can be ordered separately from Zahner.	

12	1	Conductive foam 30 x 30 mm	
13	1	Conducting metal sheet Stainless steel 80 x 60 mm	
14	1	Platinum ring electrode	
15	1	Ag/AgCl reference electrode	
16	1	Reference electrode fixture	
17	1	Counter electrode fixture	
18	2	Gas inlet/outlet fixture/olive, tube side Ø 5/6mm	
19	6	Bushing	
20	6	Allen screw M3x10	
21	6	Allen screw M3x25	
22	12	Shim	

PECC-2 – tools & spare parts

Position	Count	Description	Drawing / Picture
23	1	Hex socket driver 1.5mm	
24	1	Hex socket driver 2.0mm	
25	1	Hex socket driver 2.5mm	
26	4	O-ring sealing 26 x 2 mm	
27	1	O-ring sealing 19 x 2.5 mm	
28	4	Conductive foam 30 x 30 mm	

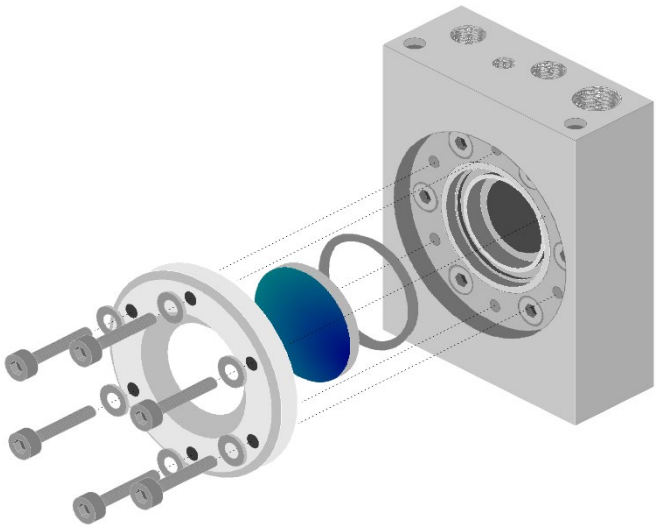
The counter electrode (CE) mounting



The Platinum counter electrode (CE) is located in the chamber behind the optical window. A 2 mm drilling hole leads the wire to the top of the cell body. The electrode

is tightened with a rubber disk by means of the fixing screw and the wire end must be fastened to the red connector.

The optical window

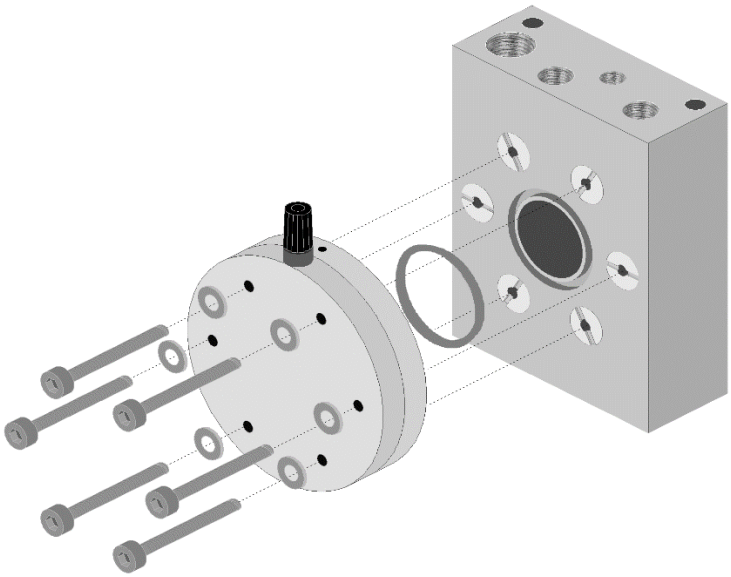


In order to mount the optical window place the green 26x2mm o-ring into the groove at the front of the cell. Place the window above the ring and fix the flange with 6 screws M3x12.

The working electrode assembly (WE)

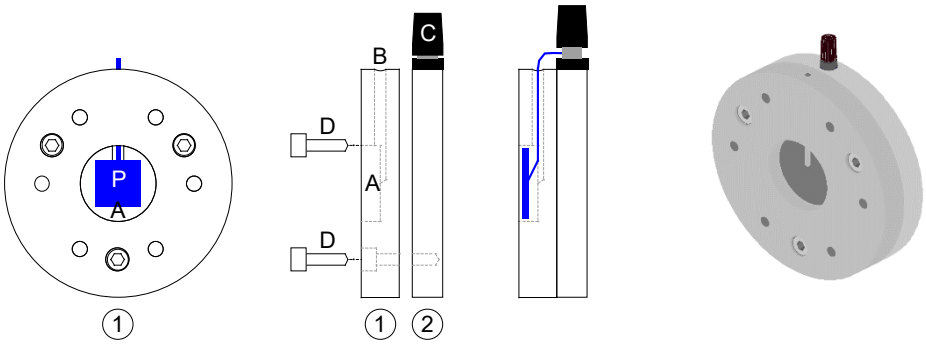
Standard WE Configuration

The PECC-2 can be used in the same way as the PECC for small sample diameters, or favourably with specimen samples, which are able to cover the electrolyte chamber's diameter to some excess.



Standard configuration for the working electrode

The standard WE holder is used for samples smaller than 18 mm in diameter, which are fixed inside the chamber of the PTFE flange. Using the standard WE holder the required electrolyte volume is 7.2 cm^3 and the light path length in the electrolyte is 23 mm.



The working electrode holder consists of an insulating specimen holder (1, PTFE) and a conducting plate (2, Alu). The specimen holder and plate are fixed by 3 screws M3x10 (D). They can easily be screwed off for cleaning purposes.

Place the specimen (P) in the small basin (A) in the middle of the specimen holder and lead the electric contact (wire) through the hole (B). Finally, contact the wire to the black binding post (C) of the plate.

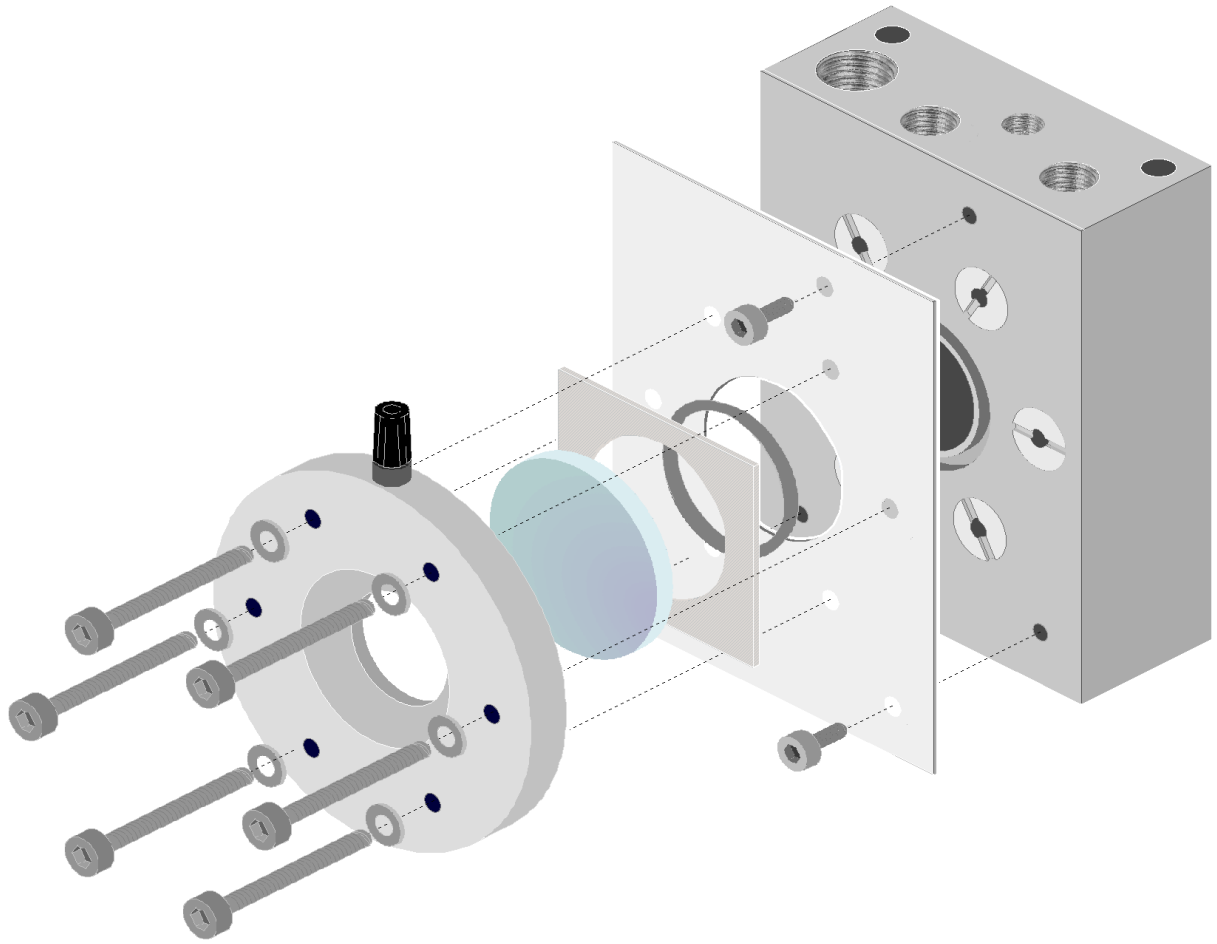
Transparent WE Configuration

Samples, which have a minimum diameter of 25 mm (at least covering the electrolyte chamber tightening O-ring) and a maximum diameter of 40 mm (fitting still between the hexagonal arranged mounting holes), can be mounted tight and contacted automatically. The wetted (active) specimen area is then ≈2.54 cm^2. The required electrolyte volume in transparent WE configuration is 5.9 cm^3 and the light path length in the electrolyte is 18 mm.

If the sample material is conducting, the working electrode connection is established simply by means of the aluminium working electrode retainer ring.

If the sample material is conducting only on the electrolyte-faced side (TCO glass, the light blue disk in the sketch), use the square conductive foam sheet with the disk-shaped spare hole in the centre between the sample and the cell. It will establish an electric contact between the conducting TCO surface and the stainless steel sheet, which in turn has a contact wire to the aluminium working electrode retainer ring.

Please note the sample material (the light blue disk in the sketch) is not included in delivery as it is specific for each customer. Standard TCO-coated glass is available separately from Zahner on request.

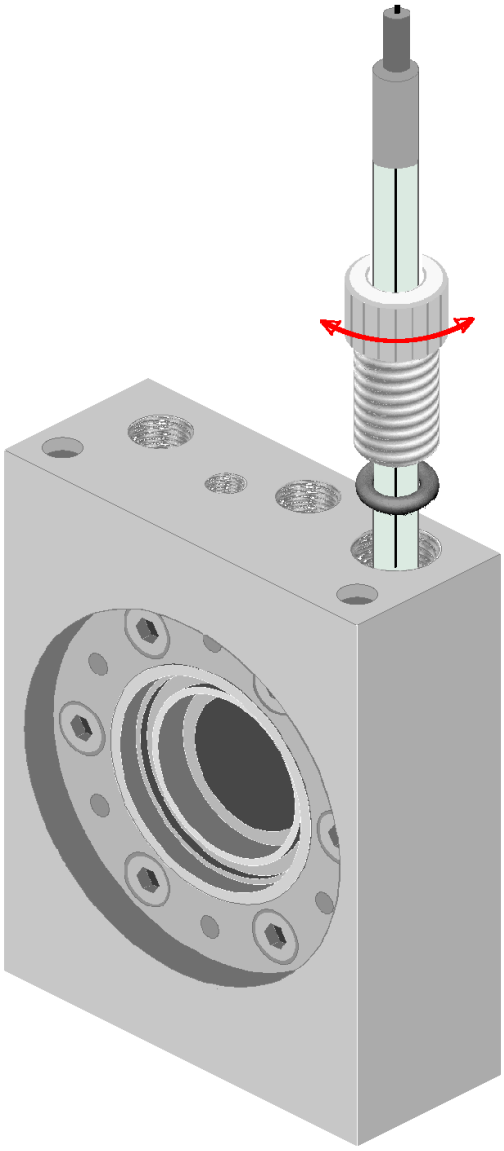


Transparent configuration for the working electrode

The estimated ratio between the incoming light and light intensity on the sample is (in a non-absorbing aqueous medium) ≈3.16 so that an effective surface of 0.81 cm^2 can be assumed for photocurrent efficiency calculations. In non-aqueous media, specific absorption has to be considered (for instance in Acetonitrile at 325 nm the damping factor is ≈18).

The reference electrode (RE)

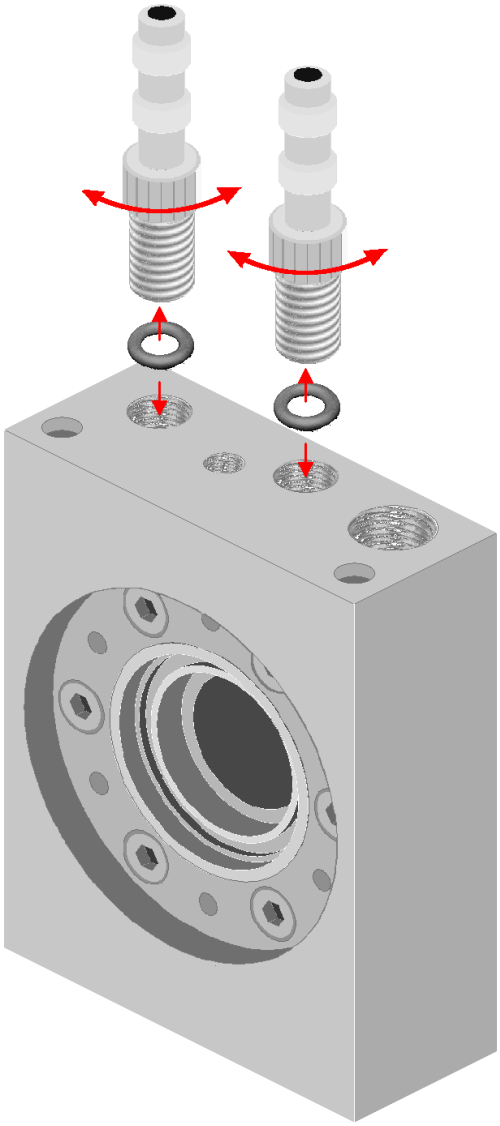
Place the Ag/AgCl reference electrode in the channel of 8 mm in diameter located on the right-hand side (view from the optical window side) of the top of the cell body. Fix the depth by moving it cautiously to the hole ground, then move it back about 1-2 mm and fix it with the screw. This procedure is recommended after filling the cell with electrolyte in order to enable on the one hand a reliable electrolytic contact between the electrolyte and reference cell mouth and excluding isolating gas bubbles in front of the electrode on the other hand. To connect the RE wiring to the potentiostat the black binding post should be used.



Attention: When using the PTFE screw to fix the reference electrode you should tighten it with very moderate force only, just to get it gas-tight. Tightening the screw too hard may damage the glass body of the RE or the thread of the fixture screw. Tightening the screw with the fingers may be difficult due to a lack of space. You may use a small pair of pliers with more success, but keep the stability of PTFE in mind!

It is recommended to check the electrolyte conduction path between RE and CE and between WE and CE respectively by means of a two-pole impedance measurement after installation. Use the potentiostatic three-electrode configuration only after having performed the upper tests successfully.

Installing the gas inlet/outlet



Put the O-rings into the bottom of the gas inlet hole located on the left-hand side (view from the optical window side) of the top of the cell body and into the gas outlet located slightly right out of the centre on top of the cell body. Screw the fixtures, until the connections are gas-tight.

Attention: When using the plastic screw olives for the gas inlet/outlet you should tighten them with moderate force only. Tightening the screw too hard may damage the thread of the fixture screw. Tightening the screws with the fingers may be difficult due to a lack of space. You may use a small pair of pliers with more success, but keep the stability of PTFE in mind!

Use not-too-stiff gas tubes (best case based on silicon rubber, inner Ø 5mm) in order not to break the PTFE worked olive fixtures.

Dismounting the PECC-2

For cleaning purposes, the PECC-2 can totally be dismounted, like the PECC.