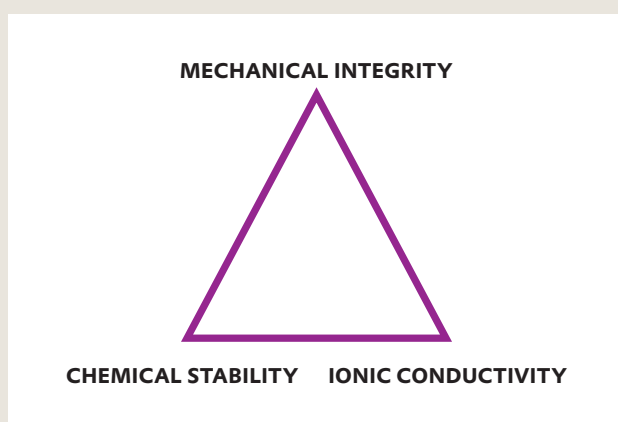




Free-standing and reinforced anion exchange membranes for alkaline water electrolysis.

GENERAL INFORMATION

DURAION® anion exchange membranes and ionomers are specifically engineered for water electrolyzers operating under alkaline conditions. They exhibit exceptionally high ionic conductivity, superior mechanical strength, and outstanding chemical stability throughout the lifetime of the electrolyzer. Evonik's polymer expertise has been key to achieving the well-balanced properties of **DURAION®** membranes, fulfilling the quality triangle required for membrane-based water electrolysis.



HANDLING AND STORAGE

DURAION® anion exchange membranes (amber-colored) are laminated onto a transparent PET carrier foil. The supplied **DURAION®** membrane is delivered in chloride form. Upon opening the sealed packaging, a slight DMSO odor may be noticeable. Since DMSO is not classified as hazardous substance, the residual DMSO content in the membrane can be considered as harmless.

Membrane dimensions might change when exposed to water, electrolyte, or high humidity. Therefore, we recommend cutting the membrane to its final dimensions after conditioning, or accounting for dimensional changes due to swelling.

HANDLING

- Wear gloves when handling the membrane to avoid contamination. Always refer to the relevant Safety Data Sheets (SDS) when working with electrolytes (e.g., KOH).
- Cut the membrane using a clean, sharp knife or punch. It is best to handle the membrane in a clean environment at room temperature with a relative humidity between 40 and 60 percent. Avoid winding, folding, puncturing, or tearing the membrane.

- If the membrane remains attached to the carrier foil under humid conditions, curling may occur. Additionally, certain manufacturing processes may introduce internal stress that can also lead to curling.

STORAGE

Unopened packages should be stored in the original shipping box, out of direct sunlight, in a climate-controlled environment. Opened rolls should be resealed and stored under the same conditions.

After conditioning, store the moistened membrane in an aqueous electrolyte (e.g., KOH), **not in pure water**. Under these conditions, the membrane may be stored for up to six weeks.

CATALYST APPLICATION

DURAION® membranes and ionomers support catalyst application either as **catalyst coated substrate (CCS)** or directly on the membrane as **catalyst coated membrane (CCM)**. Formulation guidelines for using the **DURAION®** ionomer are available upon request.

MEMBRANE CONDITIONING

During conditioning or ion exchange (in-situ or ex-situ), chloride ions and residual organic solvent (DMSO) dissolve into the electrolyte. This electrolyte must be discarded and must not be used for electrolysis operation.

DRY MEMBRANE HANDLING

1. Cut the membrane together with the carrier foil to the required dimensions. Note that membrane dimensions depend on water content. After flushing the dry-assembled cell with electrolyte, excess swollen membrane material may form folds, potentially causing mechanical damage.
2. Carefully remove the carrier foil from the membrane – avoid winding or folding the membrane.
3. For in-situ conditioning of the dry-assembled cell, follow either the **Complete Ion Exchange** or **Rapid Ion Exchange protocol**.

WET MEMBRANE HANDLING

1. Carefully remove the carrier foil from the membrane – avoid winding or folding the membrane.
2. For ex-situ conditioning, follow either the **Complete Ion Exchange** or **Rapid Ion Exchange protocol**.

COMPLETE ION EXCHANGE

1. Flush the cell or immerse the membrane in electrolyte (e.g., 1 M KOH solution) at 60 °C for approximately 1 hour. Replace the electrolyte and repeat this procedure two additional times.
2. Subsequently, leave the cell or membrane in fresh electrolyte at 60 °C overnight (~16 hours).
3. Dispose the electrolyte after conditioning.

RAPID ION EXCHANGE (> 90 %)

1. Flush the cell or immerse the membrane in electrolyte (e.g., 1 M KOH solution) at room temperature (RT) for 30 minutes.
2. Replace the electrolyte and condition for 1 hour at RT.
3. Replace the electrolyte again and condition for an additional 2 hours at RT.
4. Dispose the electrolyte after conditioning.

CELL ASSEMBLY

Electrolyzers equipped with **DURAION®** membranes can generally be operated with either a wet or dry cathode. The following guidance outlines wet and dry assembly methods, independent of the chosen operating mode.

WET ASSEMBLY

1. Mount the membranes immediately after conditioning to prevent drying.
2. Take care during gasketing and sealing electrolyzer components to avoid tearing the membrane.
3. After assembly, flush the cell or the anode half-cell with electrolyte to prevent membrane drying and shrinking.

DRY ASSEMBLY

1. Carefully mount the membranes in the cells.
2. Take care during gasketing and sealing to avoid tearing the membrane.
3. Perform pretreatment as described in the section **Membrane Conditioning**, ensuring electrolyte circulation on both sides or in the anode half-cell.
4. After pretreatment, maintain 100 % humidity inside the cell to prevent membrane shrinkage.

BREAK-IN PROCEDURE AND PERFORMANCE TESTING

To ensure complete equilibration of the **DURAION®** membrane, the following **break-in procedure** is recommended. Prior to recording a polarization curve, step 5 should always be performed to minimize the influence of reversible resistances. During operation, avoid rapid potential changes. Gradually increase or decrease the current to prevent localized current hotspots.

BREAK-IN PROCEDURE**1. Cell/setup assembly:**

- Electrolyte: 0.5–1M KOH (2 mL cm^{-2}) – both sides

2. Electrolyte heating:

- At open-circuit potential (OCP)
- Until target temperature is reached (minimum 2 hours)

3. Galvanostatic linear current ramp up:

- Start/end: 0.01 A cm^{-2} / 1 A cm^{-2}
- Scan rate: $0.4 \text{ mA cm}^{-2} \text{ s}^{-1}$
- Step size: 0.1 A cm^{-2}
- Cut-off: 2.2 V

4. Galvanostatic hold:

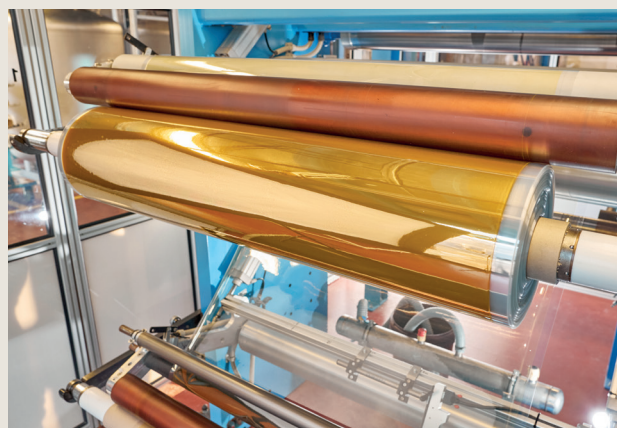
- Level: 1 A cm^{-2}
- Time: 1 h
- Cut-off: 2.2 V

PERFORMANCE TEST PROTOCOL**5. Equilibrate at low current density:**

- Apply OCP for 30 minutes

6. Perform polarisation curve:

- Each measuring point should be held at least for 30 seconds (preferably 1 minute) at 1 Hz.
- Current holds at: 0.001, 0.005, 0.01, 0.025, 0.05, 0.075, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2, ...
- Apply the same current hold steps when decreasing the current



The picture shows an exemplary **DURAION®** Membrane 101 with a width of 100 cm.

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