

Electrochemical half-element

159159

The invention relates to an electrochemical half-element for the electrochemical production of chlorine from aqueous solutions of alkali metal chloride.

5

The use of gas diffusion electrodes in alkali metal chloride electrolysis as oxygen-consuming cathodes is advantageously effected with pressure compensation between the height-dependent pressure of the sodium hydroxide solution in front of the gas diffusion electrode and the constant pressure of the oxygen behind the gas diffusion electrode, in the form of gas pockets, as presented, for example, in EP-A-0 717 130.

10

In DE 19 646 950, the gas pockets are configured such that they can be removed individually from the half-shell housing of the half-cell. This has the drawback that in the event of all the components of a half-cell being exchanged, for example for a changeover operation, all the components, in particular the gas pockets with their gas feeds and gas discharges, have to be dismantled and reassembled individually. This leads to unnecessarily long down times in the electrolyzer.

15

It is an object of the invention to provide an electrochemical half-cell for the production of chlorine from aqueous solutions of alkali metal chloride, in particular sodium chloride, which simplifies exchange of the gas pockets.

20

According to the invention, the object is achieved by the features of claim 1.

The electrochemical half-cell has an electrode space for receiving an electrolyte. Furthermore, the electrochemical half-cell has a plurality of gas pockets, the gas pockets being separated from the electrode space by at least one gas diffusion electrode. If appropriate, it is also possible for one gas diffusion electrode to be provided per gas pocket. According to the invention, the at least two gas pockets are supported by a common support element, which bears against the back wall of the gas pockets over its entire surface and/or forms the back wall of the gas pockets. In this case, the support element according to the invention in the half-cell separates the electrode space between gas diffusion electrode and ion exchange membrane from the back space, the electrode space and the back space being connected to one

30



G00002

another via one or more openings in the support element.

The advantage of the invention is that the support element forms a module with the gas pockets, and this module can be inserted into the half-shell housing of the half-cell and connected to it, in particular by welding. Connecting the module comprising support element and gas pockets to the half-shell, instead of having to connect a plurality of individual gas pockets, considerably simplifies installation of the gas pockets.

10 In a simple embodiment, the support element is an electrically conductive plate, preferably made from nickel or a nickel alloy. It would also be conceivable to use a frame-like support element, although this would have a lower mechanical stability than a support element in plate form and would therefore be less advantageous.

15 The support element according to the invention preferably forms the back wall of the gas pockets. However, it is also possible for the gas pockets to be formed completely independently of the support element and to be releasably connected to the support element in such a manner that individual gas pockets or a plurality of gas pockets together can be separated from the support element and/or removed therefrom.

20 In a further preferred embodiment, the support element is designed in well form, so that the support element completely accommodates the gas pockets. In this case, it is particularly preferable for the side walls of the support element to have a rim which rests loosely on the rim of the half-shell of the electrochemical half-cell.

25 In a particularly preferred embodiment of the invention, the support element is connected to a housing, in particular electrically conductively, via one or more bearing elements. In this case, it is preferable to use a low-resistance electrically conductive connection, as described for example in EP-A-1 041 176. The bearing elements used are, for example, trapezium or Z profile sections which are fitted to the back wall of the half-shell.

30

The invention is explained in more detail below on the basis of preferred embodiments and with reference to the appended drawings, in which:

- fig. 1 shows a diagrammatic longitudinal section through an electrochemical half-cell,
- 5 fig. 2 shows a diagrammatic cross section through the half-cell illustrated in fig. 1,
- fig. 3 shows a diagrammatic excerpt from a first embodiment of a support element arranged in a housing,
- 10 fig. 4 shows a diagrammatic excerpt from a second embodiment of a support element arranged in a housing,
- fig. 5 shows a diagrammatic excerpt from a third embodiment of a support element arranged in a housing,
- 15 fig. 6 shows a diagrammatic, perspective excerpt from the embodiment illustrated in fig. 5, and
- fig. 7 shows a diagrammatic excerpt from a fourth embodiment of a support element arranged in a housing.
- 20

The gas space can be divided into two or more gas pockets 26, 27, 28, 29 positioned above one another in a cascade arrangement (figs. 1 and 2). The gas pockets 26, 27, 28, 29 are usually separated from one another and open at the bottom toward the electrolyte. The gas from the gas pockets 26, 27, 28, 29 passes via outlet openings 10 into the back space, located behind the gas pocket 26, 27, 28, 29, of the half-element 18. In this way, the pressure in the gas pocket 26, 27, 28, 29 is kept in equilibrium, via the outlet openings 10 to the electrolyte, with the pressure of the liquid column of the electrolyte in the corresponding part of the electrode space 17 located between the gas diffusion electrode 5 and the ion exchange membrane 4. The supply of gas to or dissipation of gas from the respective gas pocket 26, 27, 28, 29 takes place via the gas inlet openings 9 or outlet openings 10. The supply of gas to the bottom gas pocket 26 may, for example, take place directly via a connection piece or an inlet 12.

25

30

The gas passes from the bottom gas pocket 26, via the outlet openings 10, into the back space 18 of the half-element. Here, the gas is collected by a gas-collection device, e.g. a gas bell 7, and is passed via the gas inlet opening 9 into the gas pocket 27 above it. From the gas pocket 27, the gas once again passes out of gas outlet openings 10, via a gas bell 7, into the gas pocket 28 above. The gas bells 7 are arranged on an outer side of a well-shaped support element 2 according to the invention.

The electrolyte is introduced, for example, by means of a distributor pipe 11 at the bottom of the half-element and then flows upward in the half-element. The electrolyte also enters the electrode space 17 through a compensation opening 13. In the electrode space 17, the electrolyte flows upward until it reaches the overflow opening 6. The electrolyte passes via the overflow opening 6 into the half-element space 18 behind the gas pockets 26, 27, 28, 29, from where it can be discharged from the half-element via an outlet 14, for example via a standpipe (not shown here).

The gas diffusion electrodes 5 are electrically conductively connected to the half-shell 1, for example at webs 16. This should be effected with a low resistance, as described for example in DE-A-196 22 744. One of the possible design variants of this low-resistance attachment is described in EP-A-1 041 176 and may be effected, for example, by means of laser welding.

A first embodiment is illustrated in fig. 3. In this case, by way of example, a plate which has been inserted into the half-shell and connected to the half-shell at the side walls of the half-shell, for example by welding, forms the support element 2. The plate is in this case connected to the half-shell 1 via bearing elements 21. The gas collection devices 7 and the gas feed openings and gas outlet openings can be fitted to the plate in the back space.

Another alternative is illustrated in fig. 4. The well-like support element 2 may, as illustrated in fig. 4, be fitted into the half-shell 1. The well or support element 2 is fixedly connected to the half-shell via trapezium or Z profile sections as bearing element 21. The connection can be effected by conventional forms of contact, such as for example welded or soldered joints. Moreover, the well 2 is connected to the

half-shell 1 at its side walls. In the back space, the gas collection devices 7 and gas feed openings and gas outlet openings may be arranged on the outer side 19 of the back wall 20 of the well 2.

- 5 As illustrated in fig. 5 and 6, the well may particularly preferably be installed in such a way that it rests loosely on a rim 23 of the half-shell 1 and is connected to the half-shell 1 via the bearing elements 21. The connection should have a low resistance. This can be effected, for example, by welding, soldering or clamping connections.
- 10 The sealing of the gas pockets 26, 27, 28, 29 with respect to the back space of the half-shell 1 is effected by means of the seal 3, which seals off the half-shell 1 with the ion exchange membrane 4.

- Another design variant is illustrated in fig. 7. In this case, the space behind the well 2
- 15 is surrounded by a dedicated sheet-metal construction 22 which is in half-shell form and serves as a bearing element, so that the gas collection devices and electrolyte supply and distribution and gas/electrolyte discharge from the half-shell can be installed therein. The bearing element 22 is connected to the part serving as support element 2, for example by means of a weld seam 25 and via webs 24.

Patent Claims

1. An electrochemical half-element, in particular for producing chlorine from aqueous solutions of alkali metal chloride, at least comprising
- 5 an electrode space (17) for receiving an electrolyte, the electrode space (17) having an electrolyte feed (11) and an electrolyte discharge (14),
- a gas space, formed from a plurality of gas pockets (26, 27, 28, 29), for receiving
- 10 gas, the bottom gas pocket (26) having a gas feed (12),
- a connecting passage (7), which connects two gas pockets (26, 27) to one another and through which the gas emerging from a lower gas pocket (26) via an outlet opening (10) flows into a gas pocket (27) above it via an inlet opening (9),
- 15 a gas diffusion electrode (5), which separates the electrode space (17) from the gas pockets (26, 27, 28, 29),
- characterized by
- 20 a support element (2) for supporting the gas pockets (26, 27, 28, 29), which support element bears against the back wall (20) of the gas pockets (26, 27, 28, 29) over its entire surface or forms the back wall (20) of the gas pockets (26, 27, 28, 29).
- 25 2. The electrochemical half-element as claimed in claim 1, characterized in that the support element (2) is formed in the manner of a well.
3. The electrochemical half-element as claimed in one of claims 1 or 2, characterized in that the support element (2) is connected fixedly, in particular by
- 30 welding, to the half-shell (1) of the half-element.
4. The electrochemical half-element as claimed in one of claims 1-3, characterized in that the support element (2) is connected to the half-shell (1), in particular electrically conductively, via one or more bearing elements (21).

5. The electrochemical half-element as claimed in claim 4, characterized in that the bearing element (21) is a trapezium profiled section or a Z profiled section.
- 5 6. The electrochemical half-element as claimed in one of claims 1-5, characterized in that the connecting passage (7) is arranged on the support element (2).