HACH-Lange Elektrochemistry
Elektrode with double junction
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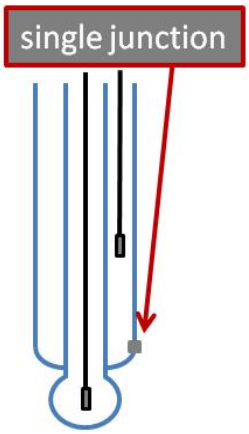
How does an electrode work with double junction?

Introduction

Electrodes with liquid electrolyte solution (pH, ORP, ISE or reference electrode) can have one oder several diaphragms. These diaphragms create the electrical contact between reference electrode and sample solution, without contamination of the sample.
Beside the various types of diaphragms (ceramic, sleeve, etc.) the orientation and position in the electrode defines its application range. There are electrodes with single diaphragm, with two or three equal diaphragms or with a double junction. What is the difference between these variations?

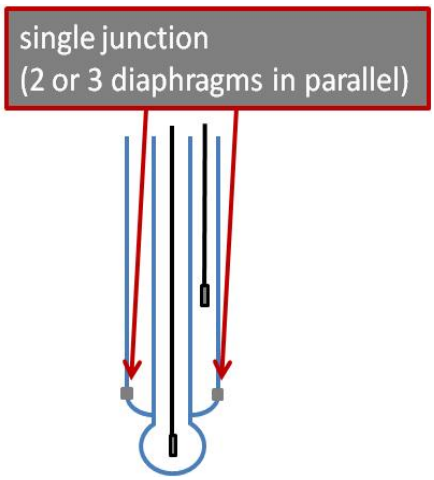
Single diaphragm (one electrolyte solution)

The electrolyte solution is in contact with sample solution through one diaphragm. With one diaphragm (e.g. ceramic) only a little volume of electrolyte can pass into the sample. With samples containing particles, the diaphragm can easily be blocked, what is indicated by increasing stabilization times up to no probe reaction.

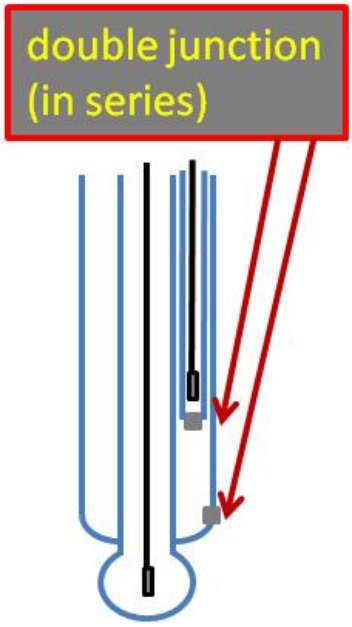


Two or three diaphragms (one electrolyte solution)

The problem of a single diaphragm can be solved by using two or three equal diaphragms in „parallel“, positioned in one level at the lower probe end. All diaphragms have the same function. This increases the electrolyte outflow and decreases the problem that a single diaphragm can be blocked by sample particles or precipitations. Mainly 2 or 3 ceramic pins are built in an electrode. Similar effects have ring diaphragms (PTFE, glass frites or sleeves).



How do electrodes work with „double junction“?



There are two diaphragms built in, but not in parallel as described above, and in series. One diaphragm is inside the electrode and protects the reference electrode from outer electrolyte. A second diaphragm provides a liquid junction to the sample solution. Therefore such electrodes need two electrolyte fillings.
The advantage of this type is indeed the filling with two electrolytes. The reference electrode remains stable in a defined electrolyte, while the second electrolyte can be exchanged to almost any solution. The inner electrolyte can be 3 M KCl, so the outer electrolyte solution can be 3 M KCl, as well, but can also have different composition. For samples sensitive to chloride ions, potassium nitrate KNO3 can be used. With reference electrodes for ISE measurements potassium sulphate or sodium acetate is recommended. This double junction type can even be used in organic solvents, where the second electrolyte is replaced by Lithium chloride (LiCl) in Ethanol. Therefore the reference system can specifically be adopted for individual samples.
In addition this double junction concept helps maintaining a stabile reference electrode over a longer period of time and acts also a silver ion barrier.