

Measurement of open circuit potential (OCP) of AC1.W4.R1 sensor vs internal and external reference Ag/AgCl electrode

Introduction:

The pseudoreference electrode on the screen printed electrode is not an exact electrochemical device. Many users are not aware of this fact. This technical data sheet demonstrate the difference of stability and precision of potential adjustment with external REF electrode and electrode printed on the SPE.

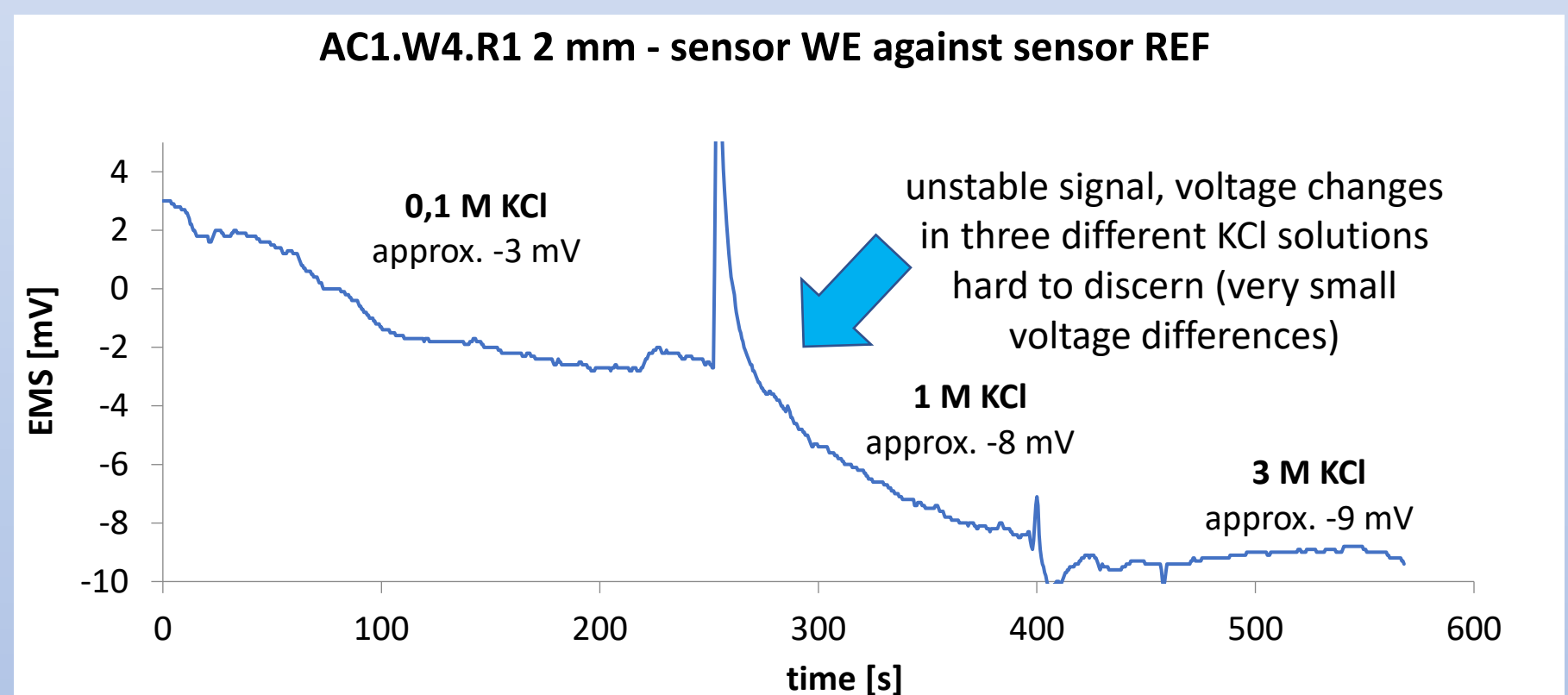
OCP measurement was performed with the same AC1.W4.R1 (SPE) sensor in a KCl solution of 3 different concentrations (0.1; 1 and 3 mol/l KCl). The aim of this measurement is to demonstrate the influence of 2 different types of reference Ag/AgCl electrodes (printed vs classic) on the obtained signal. A 15-channel potentiostat from Monokrystal was used during the measurement. This potentiostat can sample signals from up to 15 selective (or REDOX) electrodes simultaneously against a single reference electrode. 15 inputs, each with input resistance $> 10^{12}$ Ohm.

In one case, the working graphite (W4) electrode of the sensor vs. reference Ag-AgCl (R1) sensor electrode were used during OCP measurement

The electrochemical conditions of a stable reference electrode "are not met". The printed reference electrode (R1) has no internal electrolyte and no liquid junction. This is not an error but a feature - or rather the behavior of the printed reference electrode



Fig. 1: AC1.W4.R1 sensor in TC6 cell with KCl solution



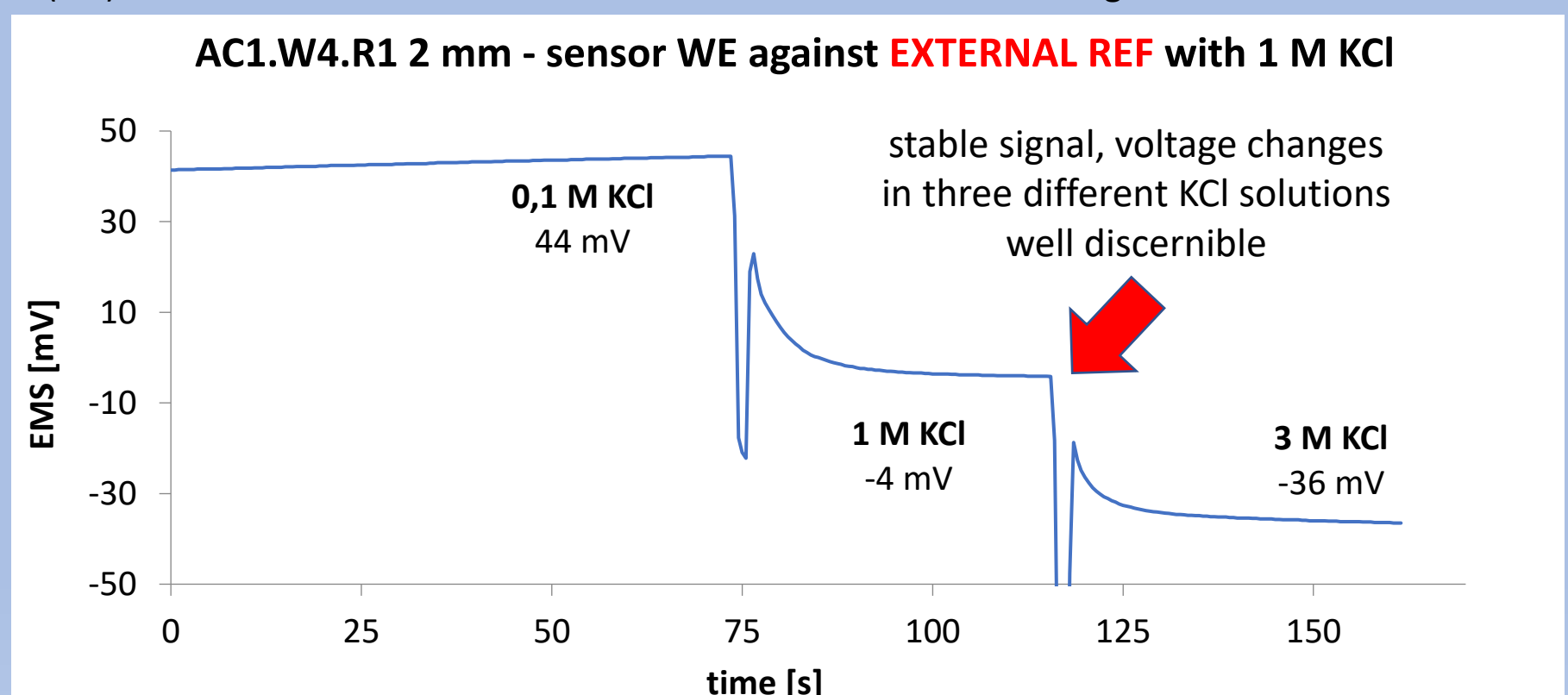
In the second case, the working graphite (W4) electrode of the sensor vs. EXTERNAL reference Ag-AgCl electrode filled with 1 mol/l KCl (internal electrolyte) were used during OCP measurement

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The electrochemical conditions of a stable reference electrode are met - the external reference electrode is separated from the measured solution by a liquid interface (frit) and the silver wire of the reference electrode is coated with AgCl.



Fig. 2: AC1.W4.R1 sensor with **EXTERNAL reference Ag/AgCl electrode** in TC6 cell with KCl solution



Conclusion:

The theoretical voltage between 0.1 and 1 mol/l KCl should be 59,2 mV. (It is less due to interaction of K^+ and Cl^- ions with graphite (W4) electrode). In case difference 1 mol/l and 3 mol/l KCl theoretical value is -28 mV and measured value -32 mV.

The comparison of Fig. 1 and Fig. 2 shows the dramatic difference between stability and performance of external (precise) reference electrode and pseudo reference electrode on the SPE sensor. If the „pseudo“ electrodes are used for amperometry, then the function can be satisfactory.

If the sensor is used in cyclic, DPV, polarography or potentiometry then the relation of the potential to the sensor reference can generate significant errors.