Conductivity measurements and effect of DC bias by a potentiostat on impedance measurements

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Conductivity values are very important pieces of information about the ions inside a solution. Conductivity not only contains some informations about the concentration of separated ions inside the solution but also it carries valuable informations about the mobility of ions. For example as a result of higher mobility of protons the measured conductivity of HCl is almost 3 times that of KCl values for the same concentrations. In addition, conductivity values can reveal the dissociation constants of ionic compounds. So because of both physical and also analytical informations (direct relationship with concentration) conductivity is very important specially for new ionic compounds in nonaqueous solutions. A 4-electrode cell along with the Solarton 4-electrode potentiostat and impedance analyzer was used to calibrate the cell with KCl which is a known salt for this purpose. The resulting molar conductivity and cell constants were close to expected values.

While measuring conductivity, gas evolution in vicinity of two outer electrodes and also some polished spots were observed. Electropolishing was a convincing explanation for that phenomenon. More investigation showed that potentiostat applies DC bias voltages during an AC impedance measurement when using a 4-electrode cell which uses 4 platinum rings as electrodes and consequently there is no actual reference electrode and as a result the potentiostat can not easily keep the DC potential versus reference electrode constant. The effect of this phenomenon on the impedance measurement was tested, which it did not show a big effect on impedance values. Some patterns of DC bias by potentiostat and some consecutive effects on impedance values will be presented.