FAQ: "Can I trust my EIS measurements?"

 Also available at www.Gamry.com

EIS Accuracy Contour Plots

Although it is very easy to make EIS measurements over a wide range of frequencies and impedances, not all measurements will represent valid impedance information. We have performed a series of impedance experiments on known resistive and capacitive cells and have evaluated the accuracy of these measurements. The results are summarized on the EIS Accuracy Contour plots for each Gamry potentiostat.

The data summarized on these contours was all taken in the potentiostatic EIS mode, using a standard amplitude of 10 mV. The green area within the center of each of the plots is that region for which the error in the impedance is less than 1% or 2°. If the impedance you measure is within the green region, then the magnitude is probably in error by less than 1% and the phase angle is probably within 2° of the true value.

Outside the green region is a small band of yellow. In this region, the measured impedances were in error by more than 1% but less than 10%, and the error in phase was between 2° and 10°. Outside of this region, bounded by the red line, the impedance of your cell cannot be measured with any accuracy. The measurement is dominated by the characteristics of the potentiostat, and not controlled by the cell impedance!

As a guideline, two capacitance values are shown on the contour plots. These help to establish the limits of believability for measured impedances. If the capacitance of your cell is smaller than the value shown, then the error is probably larger than the corresponding 1%-2° or 10%-10° limit.

If the measured impedance of your cell lies outside the green region, it may be possible to improve the quality of the impedance result by using a larger sample (for high impedance or low capacitance samples) or smaller sample (for very low impedance cells) to bring the impedance of your sample into the green region of the curve. In some cases it may also be possible to obtain better data at AC amplitudes larger than the 10 mV used here. Although that may work well for resistors and capacitors, it cannot be generally recommended for electrochemical cells. Large amplitude AC voltages may cause changes in the sample under study, or may cause non-linear effects in the data recorded.