



FAQ: Should I run EIS on my coatings vs. Eref or vs. Eoc?

© 2002 Gamry Instruments, Inc. (215) 682-9330

Also available at www.Gamry.com

Selecting a DC Voltage for EIS Measurements.

We have seen several examples where a customer has recorded an open circuit voltage of 3, 4, or even 5 volts when running EIS on a coated sample. Are these voltages real, and should you run EIS on these samples at 0V vs. Eoc?

The Eoc values that were recorded in these experiments are probably not real Eoc readings. They are probably due to an instrumental artifact. The nature of this artifact is covered in our *FAQ* "The open circuit potential for my coating is 4.9 V. Is there something wrong?"

For very, very good coatings, such as the ones that these researchers were studying, we recommended that the potentiostatic EIS measurement be done at a potential vs. Eref, not vs. Eoc. The Eoc values are often not related to the coating or to the substrate: They are a function of the length of time the potentiostat has been connected to the cell, as is explained in that *FAQ*.

The question then arises "What potential should I choose?" If the coating resistance is very high, then only very small DC currents can flow across the coating. Because the currents are small, very little damage can be done to the coating or to the underlying substrate. Consequently, 0V vs. Eref can be selected as the DC potential for the EIS scan. This value is less stressful to the coating than +5V, which may have been measured as the Eoc!

However, as the coating degrades in a long-term test, or if a hole or 'holiday' forms in the coating, some unwanted damage may happen to the underlying substrate at 0V vs. Eref. For this reason, it is a good idea to run these very good coatings at the open circuit voltage measured for the bare, uncoated substrate! There is nearly no effect of the value of the applied voltage while the coating is still intact and a very good insulator. However, if the coating fails, there will be little accidental and catastrophic damage if the substrate's Eoc is used.