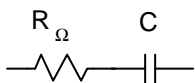


Electrochemical Impedance Spectroscopy (EIS): 4. Equivalent circuit models

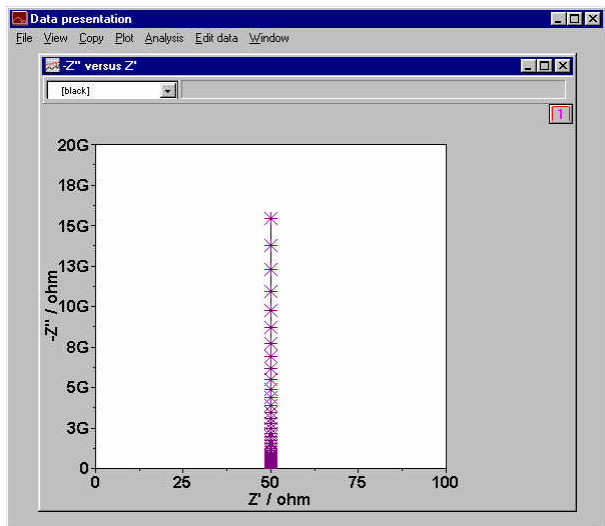
The passive circuit elements, described in the previous note on data analysis, can be combined in series and parallel to build equivalent circuit models, which can then be used to model the various phenomena going on at the interface. In this note the use of the circuit elements to build models is described.

Model 1

A resistance and a capacitance in series

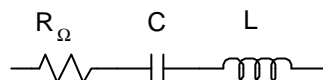


Model 1 can be used, for example, to model a metal with an undamaged high impedance coating.

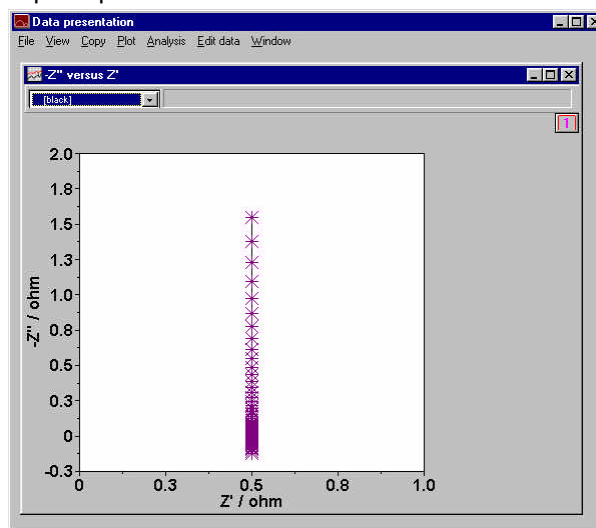


Model 2

A resistance, a capacitance and an inductance in series

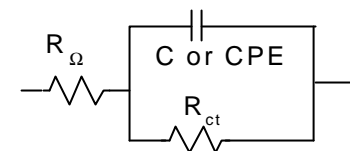


Model 2 can be used to model the response of a supercapacitor.

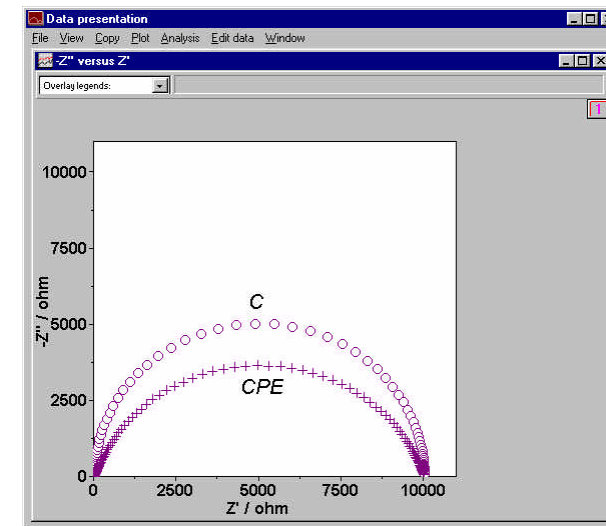


Model 3

A resistance and a capacitance in parallel (Randles circuit)

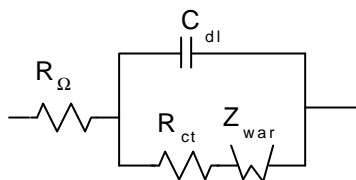


The Randles circuit is one of the simplest and most common cell models. It includes a solution resistance, a double layer capacitor or a CPE and a polarization resistance. It is used to model corrosion processes and is often the starting point for other more complex models.

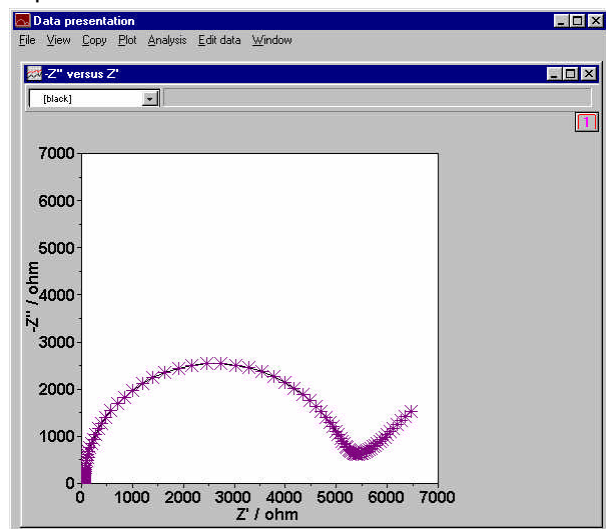


Model 4

Mixed kinetic and diffusion control

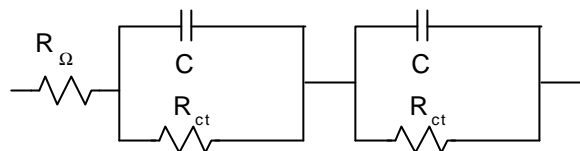


Model 4 can be used to describe electrode processes when both kinetics and diffusion are important.

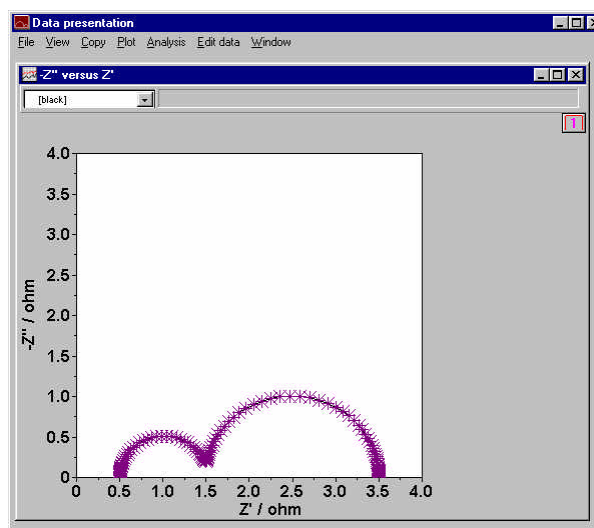


Model 5

Two Randles circuits in series

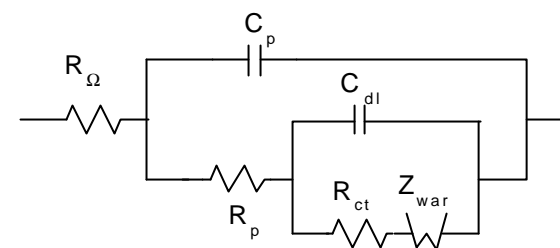


Model 5 can be used, for example, to model the response of batteries.



Model 6

A complex circuit



Model 6 can be used, for example, to describe the impedance of an organic coating on a metal substrate in contact with an electrolyte.

