

POTENTIAL DISTRIBUTIONS WITHIN COMPONENTS OF ELECTROCHEMICAL CELLS

Robert A. Huggins

Faculty of Engineering
University of Kiel
Kaiserstrasse 2
D-24143 Kiel
Germany

The output voltage of electrochemical cells such as batteries and fuel cells depends upon the difference in the chemical potential of neutral electroactive species at the two electrochemical interfaces.

Under some conditions the electrochemical interfaces are not the same as the physical interfaces. This can lead to a disparity between chemical and electrochemical potential differences.

Both the physical and electrochemical properties of materials depend upon the nature and concentrations of the mobile charged species present, which can vary with the local values of the relevant thermodynamic potentials, which are typically not uniform within electrochemical cells. Thus investigations of the properties of materials of potential use in electrochemical systems must be undertaken under conditions relevant to their employment in potential gradients.

For example, the transference numbers of particular species can vary with position within a given phase if a gradient in thermodynamic potentials is present. This can be readily understood by use of Defect Equilibrium Diagrams as thinking tools.

The use of appropriate sensors to experimentally evaluate local values of the Fermi level of the electrons and the chemical potentials of neutral species in solids will be discussed.