18. Scope of Corrosion Analyzer

Overview

Corrosion Analyzer™ is a component of OLI Studio, which is OLI's Microsoft Windows™ based simulation software. Corrosion Analyzer has evolved from the Corrosion Simulation Program (CSP) developed in the latter half of the 1990's.

The purpose of the CSP project was multifold:

- To create generalized "real solution" stability diagrams.
- Develop a comprehensive redox databank.
- To create a thermodynamic model for alloys.
- To develop a rates-of-corrosion model.
- Create a model for growth and breakdown of passive films.
- Create a model for localized corrosion.
- Create a model for predicting the time evolution of corrosion using extreme value statistics.

Much of the projected goals of the original CSP project have been completed but there is still much to do. Starting in year 1999, the CSP program was converted, with much effort, to Corrosion Analyzer.

This course assumes that the user is familiar with the basic functionality of OLI Studio. Many of the calculation techniques described in the OLI Studio User Guide are also used in Corrosion Analyzer.

Thermodynamics of Corrosion

The thermodynamics of corrosion is predicted using the traditional OLI thermodynamic model along with specific enhancements required for the Corrosion Analyzer. Specifically, the thermodynamics of corrosion answers the following questions:

1. When are metals immune to corrosion?
2. When can they passivate?

The tool that answers these questions is *Stability diagrams.*

Kinetics of general corrosion

Once the thermodynamics of corrosion have been determined, we would like to be able to predict rate of corrosion. Extensive research has been completed by OLI

Systems, Inc. in this area and will be discussed in later chapters. Specifically the question asked is:

What is the rate of corrosion?

A large database of corrosion data has been fit for this question. The program will determine amount of material that will corrode, in a generalized setting.

Other phenomena

Several other thermodynamic properties (not required to solve the equilibrium based model) were also developed for both the stability and rate of corrosion. Some of these phenomena are:

- Electrical conductivity
- Viscosity
- Diffusivity

Real-solution stability diagrams

The design goals of real-solution stability diagrams are:

- To predict the stability of metals, metal ions, oxides, etc. as a function of T, P and solution composition.
- Draw conclusions about the ranges of immunity to corrosion, possible passivation and dissolution of metals in the presence of species that promote or inhibit corrosion.

Some of the features of a real-solution stability diagram are:

- Potential versus pH with other variables fixed (a real-solution analog of the Pourbaix diagrams)
- Potential versus concentrations of active species (either inflows or species in equilibrium)
- Predominance areas as functions of concentrations of selected species without using E as an independent variable

Assumptions

We assume that you are already familiar with the OLI Studio software. We will not go into great discussions about how to use the software unless it is related to corrosion.