Abstract

A thermogalvanic cell is formed when an electrical contact is established between two similar electrochemical half-cells, each one kept at a different temperature. Any increase of corrosion taking place in one of the electrodes as a consequence of the coupling of both half-cells is known as *thermogalvanic corrosion*. Thermogalvanic corrosion can be responsible for the corrosion damage in some industrial sectors, especially in processes where heat exchangers are employed. Moreover, thermogalvanic corrosion can cause early failure in supply systems and pipes, especially those made of copper, exposed to permanent temperature gradients. So far, no studies concerning thermogalvanic corrosion in LiBr absorption machines have been carried out. The conditions inside these machines are very aggressive and promote the appearance of thermogalvanic phenomena: high temperatures (up to 150-160º C) and highly concentrated LiBr solutions (up to 1080 g/l). In this context, an exhaustive study on the thermogalvanic corrosion of two metallic materials widely employed in different parts of LiBr absorption machines (Alloy 31 and copper) has been carried out in this Doctoral Thesis.

It has been observed that Alloy 31 has a high resistance to thermogalvanic corrosion, while this type of corrosion can lead to severe problems in the case of copper. Moreover, when electrically coupling Alloy 31 and copper in the presence of a temperature gradient, an increase in the Alloy 31 temperature has been observed to enhance its cathodic behaviour, which can gravelly aggravate the problems of thermogalvanic corrosion of copper.

On the other hand, since the excellen behaviour of Alloy 31 against thermogalvanic corrosion is due to the phenomenon of passivity, the passive properties of this alloy in concentrated LiBr solutions and at different temperatures have been studied in detail in this Doctoral Thesis. A theoretical model, the *Point Defect Model* (PDM), has been used to explain the properties of passive films, as well as the processes of formation, growth and breakdown of these passive films.

The obtained results have demonstrated that both the density of defects and their mobility inside the passive films increase significantly with increasing the system temperature. These results clearly indicate that passivity breakdown and the onset of pitting corrosion are more likely to occur at elevated temperatures.