Chlorinated Cold Water Treatment of Alloys for Long Term Corrosion Protection - P. Natishan (Naval Research Laboratory), F. Martin (GEO-Centers, Inc.), and W. O'Grady (Naval Research Laboratory)

Stainless steels have been used for many years in applications where an increased resistance to corrosion is needed. The duplex stainless steels (DSS) which are a 50/50 mixture of austenite-ferrite structure with increased levels of Cr and Mo relative to the 300 series austenitic alloys have found widespread use especially in the oil and gas industry piping systems. However, these alloys can still undergo localized corrosion in the form of pitting or crevice corrosion in many environments.

Recently, it has been shown (1) that the treatment of duplex stainless steel pipes with chlorinated low temperature sea water lead to significant improvement of the corrosion life time of these pipes. As a result of these observations the low temperature chlorinated water treatment has become standard protocol (1) for the duplex SS that will be used with sea water. There has been no fundamental research in this area and it goal of this work to determine the nature of the surface modification that has provided the increase in corrosion resistance. This treatment has only been used on duplex stainless steels and a second aspect of this work will be to determine if the chlorinated low temperature sea water treatment is effective in increasing the corrosion resistance of other alloys.

This communication compares the surface composition information obtained using x-ray photoelectron spectroscopy (XPS) for alloys that were exposed to either chlorinated low temperature sea water or ambient temperature seawater with no chlorine. Alloys examined included Zeron 100 (for which the original data was obtained), a Ni-Cr-Mo alloy, 625, and 304 stainless steel. The most notable of the initial results is that the samples exposed to the chlorinated low temperature sea water had no Cl peak in the XPS spectra but that the samples exposed to ambient temperature seawater with no chlorine did have a Cl peak. This result is interesting since Cl uptake by oxide films is an important step in passive film breakdown leading to localized corrosion.

References:
(1) Weir Materials, private communication (2003).