

THE ROLE OF CHROMATE IN
PREVENTING UNDERMINING
COATINGS. A XANES INVESTIGATION.

N. Le Bozec¹, T. Prosek², and D. Thierry²

1: Institut de la Corrosion, Technopôle Brest
Iroise, Rue Descartes, 29280 Plouzané,
France

2: Swedish Corrosion Institute, Kräftriket
23A, 104 05 Stockholm, Sweden

Chromate is used as a conversion coating and in primers for coil-coated steel used in the building industry and for aluminum alloys used in the aerospace and automotive industries. Chromate provides excellent protection at defect areas such as cut-edges and scratch. However, chromate is toxic and there is therefore a need to develop environment-friendly alternatives. Hence it is vital to better understand the mechanisms of inhibition of chromate.

X-ray absorption near-edge structure (XANES) has proven to be a powerful technique for the *in-situ* study of inhibiting species in passive films and in solution. In particular the technique can be used *in-situ* to detect metal ion concentrations during dissolution processes. Using XANES, the valence state of species present at very low

concentration (in the range of a few monolayers) can be determined in air, in an electrochemical cell and even under highly resistive polymers.

The mechanisms of inhibition of chromate conversion coating on aluminum alloy AA6016 and zinc have been studied using X-ray absorption near-edge structure (XANES). In the case of aluminum alloy AA6016, the results showed that Cr(VI) is preferably leached out at the opening of the filament, whereas Cr(VI) seems to be reduced to Cr(III) at all other locations. The leached out Cr(VI) is mainly accumulated in the pitting area, located in the scratch just outside the filament. The released chromium from the CCC is partly reduced to Cr(III) in the pit. The formation of an Al/Cr mixed oxide was observed in the pitting area. The repassivation of pits in the scratch by the chromate leaching from the CCC close to the scratch explain the low number of initiation sites observed for the chromated surfaces.

The mechanisms of inhibition of chromate conversion coating on zinc have been also studied. The effect of $\text{CrO}_4^{2-}/\text{Cl}^-$ ratio on the corrosion resistance has been studied using XANES. The inhibitive action of vanadate conversion coatings is also discussed.