Local electrochemical and spectroscopic study of the corrosion inhibition of zinc-coated steel by means of chromic treatments

Zineb Mekhalif,[1] Laurent Forget[1] and Joseph delhalle[1]

[1] Facultés Universitaires Notre-Dame de la Paix
Départ. Chimie, LISE, 61 rue de Bruxelles
Namur 5000
Belgium

The purpose of this contribution is the simultaneous application of local electrochemical techniques, such as the scanning Kelvin probe, in addition to spectroscopic and traditional electrochemical methods. These investigative tools are used in order to advance the understanding of the corrosion inhibition mechanisms of chromated galvanised steels.

Our interest was specifically focused on an industrial passivation treatment. For the study of this treatment, we started by using classical means: XPS and Auger spectroscopies were used to get information about the nature of the deposited layers and polarization curves were built to evaluate their inhibitive effect.

The following step of our study consisted in using the scanning Kelvin probe to evidence, in atmospheric corrosion, the exclusively cathodic inhibition mode linked to the industrial passivation treatment. Other aspects such as the influence of phosphates or the evolution of the chromic treatment in a corrosive medium were investigated by the measurement of local corrosion potentials and of local current densities.

The transposition of this type of study to a case of laboratory passivation treatment, completed by polarization and exposition to UV- ozone tests, allowed us to bring to light the essential role of the surfactants in the corrosion inhibition mechanism linked to this particular kind of treatment.

An additional study stressed the existence of a synergy between surface active molecules and the chromic treatment. It also emphasised the influence of this synergy on the corrosion resistance of chromated substrates.

Furthermore, the measurement of delamination profiles enabled us to show the influence of the chromating treatment and the surfactant on the corrosion of polymer-coated metal surfaces.

Financial support:

- the Belgian interuniversity attraction pole on “Reduced dimensionality systems” (PAI/IUAP 4/10) initiated by the Belgian office for Scientific, Technical and Cultural Affairs (OSTC)
- the “Front National de la Recherche Scientifique” (FNRS)
- Usinor-RDCS