

A new flow cell for spectroelectrochemical experiments: In situ studies of corrosion process of light metals

In order to monitor composition and structural changes occurring on electrode surfaces microscopy and /or spectroscopy techniques have to be combined to the electrochemical interface. Infrared spectroscopy is an excellent analytical tool for the analysis of the chemical composition of various molecules. Moreover, due to the fact that various functional groups absorb the IR light at different frequencies, complex composition of a sample does not limit the resolution of this technique. Reflection based IR techniques are applicable to studies molecules adsorbed at solid surfaces and they have been successfully employed to the electrochemical interface.

In this work a new flow spectroelectrochemical cell will be built and tested for *in situ* studies of corrosion processes of light metals such as magnesium and aluminum. In air both metals are covered by a passivation layer. On the Mg surface magnesium oxide, hydroxide and carbonate have been found. On the Al surface the passivation layer contains predominantly aluminum oxide. It is well known that in aqueous electrolyte solution the corrosion process of both metals depends on the composition of the electrolyte solution.

In order to understand the sequence of events accompanying metal corrosion process *in situ* polarization modulation infrared reflection-absorption spectroscopy experiments in a flow cell will be performed. This unique cell construction will allow to measure the PM IRRAS spectra *in situ* after diverse times of the exposure of a studied surface to a given electrolyte solution. In this way a possible formation of diverse products and their reactivity as a function of time will be tested. Conditions facilitating and slowing down corrosion will be tested. Natural polymers such as proteins and polycarbonates will be dissolved in the electrolyte solution. The impact of adsorption of an organic film on the metal surface on corrosion progress will be investigated.

In parallel XPS will be employed to determine the element composition and chemical environment of studied metal surfaces during the progress of the corrosion process. This technique provides complementary information to PM IRRAS on the surface composition and reactivity. This approach will provide a sub-molecular level image of the corrosion process of metallic surfaces.

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