Surface Chemistry and Corrosion Studies of Zn–Al and Zn–Mg–Al Alloy Coatings

Abstract

Alloy coated steel is one of the main raw materials of automobile, appliance and construction industries. Binary or ternary mixtures of zinc (Zn), aluminum (Al) and magnesium (Mg) are the most frequently used alloy coatings to increase the corrosion resistance of steel. In most cases the steel sheets are additionally coated with polymeric layers like paints or adhesives.

The design and development of corrosion resistant polymer/zinc interfaces are of high importance for organically coated or adhesively bonded galvanized steel substrates.

The aim of the present work is to contribute towards a better understanding of the corrosion mechanisms on zinc alloys and to investigate, based on this fundamental knowledge, the applicability of organophosphonic acids for corrosion protection and adhesion promotion on novel Zn–Mg–Al alloys. Even though there is extensive amount of data in the literature on the macroscopic corrosion properties and corrosion resistance of zinc alloy coatings, initial stages of the corrosion processes and the influence of the microstructure of the alloy coating on the corrosion mechanisms is not clarified so far. The chapters 5 – 7 are thus devoted to the analysis of initial stages of corrosion processes by means of in–situ Raman spectroscopy. The influence of the pH and the variation of the electrolyte exchange rate were investigated.

Moreover, the adsorption and stability of organophosphonic acid monolayers on plasma modified Zn–Mg–Al alloys was studied by means of spectroscopic and microscopic techniques.

Furthermore, aminopropylphosphonic acid was investigated as a short–chain bi–functional adhesion promoter between a plasma modified zinc magnesium aluminum alloy coated steel and an epoxy amine adhesive.