Corrosion protection properties of formed, organically coated electro-galvanised steel

Abstract

Coil coated steel is a composite material of a normally galvanised steel coated with one or more organic layers. It is one of the premium products of the steel industry and gives large benefits to the costumer like the effort reduction in their paint shops and further improvements in the corrosion resistance.

The formability of organic coatings on steel is a precondition for the application of pre-coated (coil-coated) steel in various technical applications. Especially at high forming degrees or at cut edges, defects appear within the organic coating. These defects influence the ensuing processing technology as well as the long-term stability of the material.

The scope of this thesis was the development of new analytical tools to investigate the formability, corrosion and barrier properties of organic coatings applied on electrogalvanised steel. Thereby the work was focused on innovative, combined in-situ methods which allow gaining detailed information about the system under investigation. A new electrochemical capillary cell setup was build, combining impedance spectroscopy with simultaneous forming of a sample. This setup allows detailed information about the loss of the barrier properties during stretch forming by the formation of defects and the corrosive attack of the electrolyte. Further results of the local loss of barrier properties and the corrosion product formation can be obtained from the combination of a Raman spectrometer with an electrochemical capillary cell. Finally a new in-situ Raman / QCM flow cell allows measuring absorption kinetics and dissolving processes of e.g. inhibitors and further on allows identifying the products involved.