Imperial College London

Project: Materials degradation and electrochemistry in confined geometries

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Industry partner: BASF

Abstract: Techniques to be deployed: Nanolithography, on-line Electrochemical Mass Spectrometry, Secondary Ion Mass Spectrometry, Vibrational spectroscopies, Environmental-SEM.

In this project we will improve mechanistic understanding of undercoating degradation processes with particular focus on surface dissolution, oxygen reduction behaviours and polymer degradation processes (in particular in response to by-products of ORR). in particular the nature and concentrations of reactive species in the confined space between metal and coating and their role in polymer degradation. Stage one of this project involves the design and creation artificial systems using 3D printing and nanolithography that mimic confined geometries and defects of under-coating corrosion – and establishing protocols to link these model systems to industrial systems. On line on-line ICP-MS will be developed to study products of cathodic reactions, enabling elucidation of the and the role of substrate chemistry (project 1) and local defect structures in driving these reactions. The correlated polymer degradation will be studied using operando vibrational techniques as well as ex situ SIMS and XPS. This approach will allow us to probe the role of the oxygen reduction reaction in polymer degradation, leading to new insights for coating development.