

**Project: Operando spectro-microscopic studies of interfaces in coated system**

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**Abstract:** Techniques to be deployed: Scanning Electron Microscopy, (cryo)Transmission Electron Microscopy, (cryo)Atom Probe Tomography (SEM, TEM, APT); In situ X-ray Absorption Spectroscopy and Transmission X-ray Microscopy (XAS, TXM); correlated with Environmental SEM and XPS/SIMS to determine surface chemistry and morphology ex situ. In this project we will develop approaches to study the nanoscale chemical and structural changes that occur during materials processing, coating and lifetime. The work will involve the design of model systems that are representative of the real world scenarios – as well as correlative measurements on samples provided by our industrial collaborators. In particular we will focus on:

- a) Surface pre-treatment processes and interactions between thin film treatment and coating. Using operando XAS to determine deposition kinetics, and TXM to map local chemistry, and chemistry evolution during processing. Detailed surface characterisation pre- and post- treatment will be used to determine the chemistry and structure 'presented' to the coating.
- b) Determination of chemical gradients across interfaces (substrate – thin film – coating). In particular the distribution of water and organic functional groups will be determined using cryo-TEM and APT (note there is a significant developments in sample geometry / preparation to enable these measurements). This work will inform key questions around the interfacial bonding and the role of boundary layer water in the induction period of corrosion.