

## **Development of A Liquid Cell Based PM-IRRAS Technique to Investigate the Interfacial Corrosion of Iron at Air/Electrolyte/Metal Interfaces under Different pH Conditions**

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Corrosion is one of the main issues faced by all over the world fundamentally involving surface chemical reactions in complex environments. The iron corrosion involves surface oxidation resulting in primary and secondary corrosion products with many oxidation states of iron. The oxidation state and the composition of corrosion products depend upon the chemical makeup of the electrolyte (ions, water, H<sup>+</sup>, OH<sup>-</sup>) and exposure to gases (O<sub>2</sub>, CO<sub>2</sub>) in these complex environments from the electrochemical process. These redox reactions on iron surfaces play a vital role in water chemistry and influence in soil chemistry in water cycle and mineral cycles. Investigating the physical and chemical driving forces of surface corrosion under different complex environments helps to uncover the mechanisms on iron interfaces relevant for processes in electrochemical energy, mineral and water cycles, and preventing material degradation.

Our group has designed a new *in-situ* IR spectroscopic method to study the interfacial corrosion of iron at air/electrolyte/metal interface under ambient conditions. Polarized modulated infrared reflection absorption spectroscopy (PM-IRRAS) is a vibrational spectroscopic technique that is used to measure vibrational signatures on reflective surfaces. We have developed this technique to study the rate of interfacial oxidation that leads to corrosion and identify the composition of surface species that are formed as a function of time and the pH of the electrolyte. Three chloride solutions of different pH (HCl(aq)-acidic, NaCl-semi neutral and NaOCl-basic) were used as electrolytes and the PM-IRRAS spectra were collected at the air/electrolyte/iron interface. Both the oxidation (anodic reaction) of iron to Fe<sup>2+</sup> and water reduction (cathodic reaction) occur on the surface of iron depending on the oxygen and CO<sub>2</sub> concentration. The corrosion products are grown on the cathode side (interface). We suggest mechanisms that lead to the observed surface oxidation species (corrosion products). The findings of this research work measured the variation of the composition of interfacial corrosion products as a function of time and the pH of the electrolyte.