How to study interfacial reactions at the buried interface between organic coatings and metals

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Interfacial interactions between metals and an organic coating are mainly determining the durability of the entire organic/inorganic hybrid system. However, analyzing this solid/solid interface is challenging. Since this region is covered by a µm-thick polymer layer on one side and a metal oxide matrix on the other, the use of conventional surface analysis techniques to probe this region is hindered and this region is therefore often referred to as the buried interface. To understand this region, there has been a tendency to model the organic over layer by organic molecules with the functional groups of interest. Here, we characterize interfacial interactions of several polymeric films with metal oxide by utilizing novel methodologies. This approach leads to the in situ characterization of a more realistic model interface and this even when the systems are exposed to relevant environmental conditions such as water ingress, etc. The use of Ambient Pressure X-ray Photoelectron Spectroscopy (APXPS) is employed to describe the behavior of interfacial interactions in the presence of water vapor. Furthermore, combined ATR-FTIR Kretschmann with ORP- EIS is utilized to obtain a near-interface infrared spectrum while simultaneously, the influence of an above-the-polymer electrolyte (such as water) on the interface is characterized. The local deposition of organic molecules we try to probe by Nano IR or TOF-SIMS/AFM approaches. This work shows using a set of recently developed techniques, it is possible to non-destructively and in situ probe interfacial changes in hybrid systems.

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