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Research interests:

Corrosion, interfacial delamination, SKP, electrochemical recycling, energy storage and conversion.

## Investigating water transport processes and stability of a steel-methacrylate based adhesive interface under harsh marine conditions

The application of adhesively bonded structures in marine environment is under intense investigation as they can reduce weight while preserving strength. However, the utilization of adhesives in marine environment has been limited due to the adverse impact of water over long term durability of the joints. Combined effects of moisture, loading and temperature often result in permanent damage to the adhesive through hydrolysis, plasticization and eventually in the delamination of the adhesive from the substrate-adhesive interface.

We investigated the corrosive interfacial delamination processes at the steel-adhesive interface. A spectroelectrochemical technique, Fourier Transform Infrared Attenuated Total Reflection (FTIR-ATR) with Kretschmann geometry integrated with electrochemical impedance spectroscopy (EIS) was used to quantitatively measure the diffusion coefficient as well as the effect of water uptake on the interfacial chemistry of the metal-polymer interface. The diffusion coefficients calculated using the Brasher-Kingsbury equation (EIS) and with the Fieldson-Barbari equation (ATR-FTIR) were in agreement with each other and in the same order,  $10^{-10} \text{ cm}^2\text{s}^{-1}$ . The interfacial delamination of the adhesive from the interface could be observed with the appearance of second time constant in the EIS measurements after 140 hours.

Subsequently, the water uptake behaviour of the adhesive at various temperatures will be

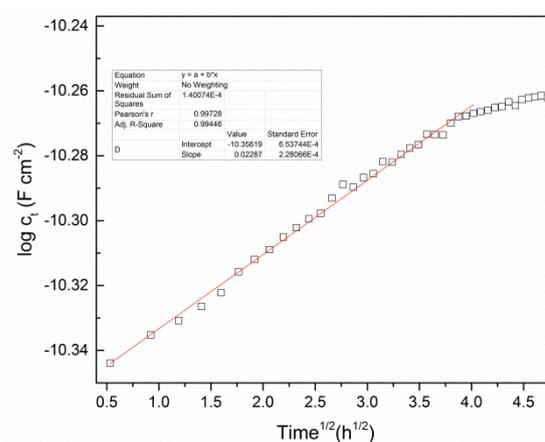


Figure 1: Capacitance- time curve of adhesive-steel system.

analysed using gravimetric analysis. Scanning Kelvin Probe technique will be used to understand the mechanism and the rate of delamination at the steel-adhesive interface under differently pre-treated steel surfaces.

Key publications:

1. **P. Venkatesan**, T. Vander Hoogerstraete et al., Green Chemistry, 2018, 20, 1065
2. **P. Venkatesan**, T. Vander Hoogerstraete et al., ACS Sustainable chemistry and Engineering, 2018, 6(7), 9375
3. **P. Venkatesan**, Y. Yang et al., Separation and Purification Technology, 2018, 191, 384

