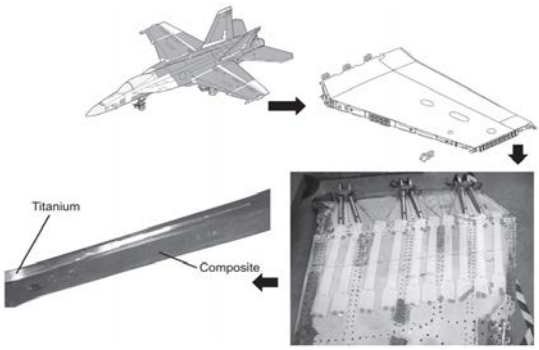
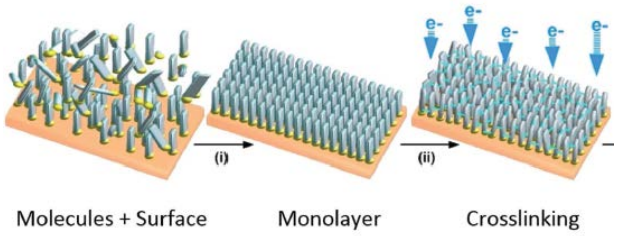
MSc project at MS3 department

Improving the long-term performance of a metal-thermoplastic hybrid joint using Carbon Nanomembrane coatings

The metal-thermoplastic hybrid joint is playing an increasingly important role in light-weight constructions, especially in the aerospace and automotive applications. The interaction between thermoplastic polymers and the metal part is understood in terms of physical and chemical bonding at the solid-polymer interface, as well as mechanical interlocking determined by the surface roughness. For the long-term joint performance, the diffusion and adsorption of environmental water is a key factor, which is strongly determined by the physicochemical properties of the metal surface. Thus, tailoring the physicochemical properties of the metal surface is crucial for improving the bonding strength of a metal-thermoplastic joint and its long-term performance.

Carbon nanomembranes (CNMs) are synthetic 2-D carbon coatings with tailored physical and chemical properties. Due to its easy-processing for a large area coating on rough surfaces, high mechanical strength, thermal stability, and high functionality, the CNMs materials have high potential to be used as a surface coating for the metal-thermoplastic joints.





Carbon nanomembranes coating

This MSc project will study the applicability of CNMs in this field, by collaborating with the research group from Bielefeld University and CNM Technologies GmbH in Germany (the leading groups working on CNMs coatings).

Project plan

1. Preparation of the carbon nanomembrane (CNM) coating on the metal surface with tailored physical and chemical properties.
2. Characterizing the surface physicochemical properties of the CNM coating with tailored chemical functionality, using contact angle measurement, atomic force microscopy (AFM) and Raman spectroscopy.
3. Measuring the long-term performance (in humid condition) of a metal-thermoplastic joint using the Ploughing method. The stainless steel and Titanium, as the metal surfaces and PA 6 and PEKK, as the thermoplastic polymers will be used.
4. Propose the optimized design of the CNMs coating to improve the long-term performance of the metal-thermoplastic hybrid joints.

Interested? Contact Dr. Liangyong Chu (L.Chu@utwente.nl), or Prof.dr.ir. M.B. de Rooij (Matthijn) (m.b.derooij@utwente.nl).