Design and development of innovative and hybrid polymeric materials for wind energy

In this assignment, new materials will be developed by combining thermoplastics with thermoset polymers/composites which is foreseen as the future for applications in wind turbines. The challenge is to understand and describe the interfacial bond strength in between thermoset and thermoplastic which is influenced by the interface morphology. The incomplete or poor bonding (**Figure 1 (left)**) at the interface between different or similar polymers within co-bonded composites is one of the most important defects and the main threat for FRPCs because incomplete or poor bonding is not readily predictable and hardly detectable in a non-destructive way. *How to design this interface remains an unsolved problem. This hampers the further development of hybrid composites seen in **Figure 1 (right)**.*

The main research question is:

How can we design and develop a co-bonded composite with high quality and high bond strength?
And what would be the design guidelines to manufacture this hybrid material?

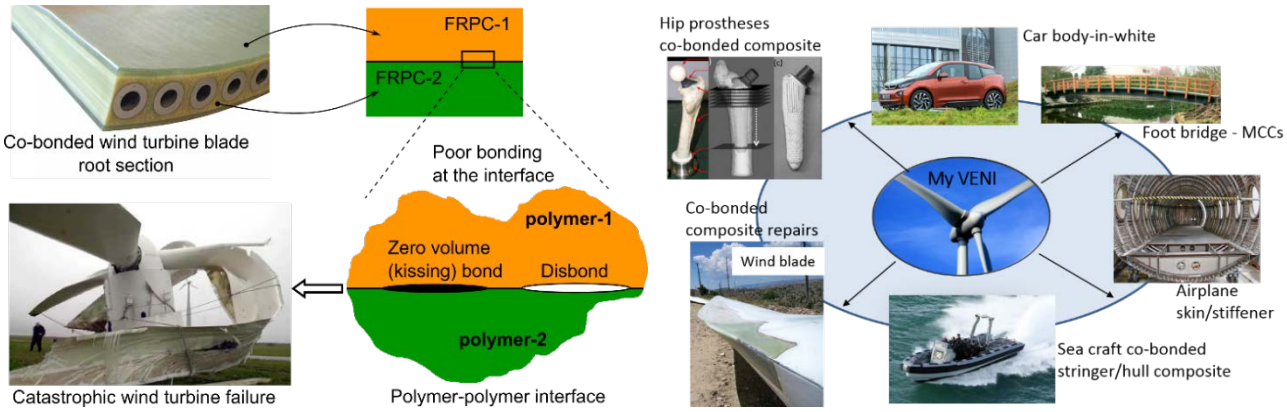

Figure 1. Poor bonding at the polymer-polymer interface (left). Application areas of co-bonded hybrid composites (right).

Possible research topics:

- Study the effect of processing conditions on the development of interface morphology (see **Figure 2**)
- Study the effect of matrix material type on the interface birefringent zone (see **Figure 2**)
- Study the effect of surface roughness on product quality and bond strength
- Study the possibility of producing good bonding between thermoset and thermoplastic material
- Study the process induced warpage which is currently not predicted due to lack of information at the interface
- Develop a computational simulation using FEM for co-bonded composites

LM Wind Power, TPRC and TenCate will supply the materials for testing.

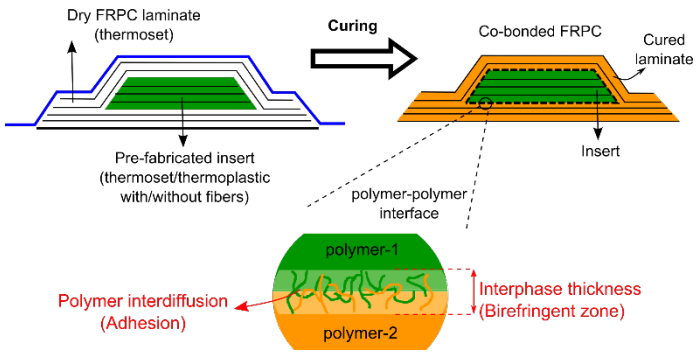

Figure 2. Schematic view of a co-bonding process with details of the interface region.