UNIVERSITY OF TWENTE. | Surface Technology and Tribology

TPRC THERMOPLASTIC COMPOSITES RESEARCH CENTER

MSc Assignment

HYBRID ADHESIVE TO JOIN THERMOPLASTIC TO THERMOSET COMPOSITES

The known benefits of thermoplastic composites (TPC) – rapid processing, inherent toughness, environmental stability – can be exploited to a greater extent when they can be applied in multi-material designs. Of specific interest is the mixed use of TPC with the more widely applied thermoset composites (TSC), which have become the first material of choice in lightweight aerospace structures. As both types of material families possesses different properties, joining them in a robust way to serve in semi-structural aerial applications, is a big challenge and of high interest.

Adhesive bonding is a commonly used approach to bond two substrates with an intermediate binder, e.g. adhesive film. One of the major advantages of currently used thermoplastic composites is the main reason for the limited use of adhesive-based bonding: the excellent resistance to fluids. The polymer matrices PEEK, PEKK and PPS are nearly insoluble to any solvent, and thus lack affinity with adhesives. As of today, in order to improve adhesion properties for bonded joints, different surface treatment methods are needed for the mentioned thermoplastic polymers. One novel approach to eliminate or minimize the need for these treatments is to incorporate a hybrid adhesive, by encompasses components to affiliate to both substrates.

Research group & Company

The ***Surface Technology and Tribology*** (STT) group will organize the research with a focus on surfaces and interfaces in an engineering context, as well as degradation mechanisms occurring at these surfaces and interfaces. The researcher will closely collaborate with ***ThermoPlastic composites Research Center*** (www.tprc.nl). The TPRC is an open research center for fiber reinforced thermoplastic composites. TPRC performs research in co-operation with national and international partners, such as Fokker, Toray and Boeing, on the processing and performance of thermoplastic composites.

Tasks:

You are asked to perform a research study with the goal of presenting a bonding solution for TPC and TSC using hybrid adhesive. The aim is to mechanically test coupon level joints for different adhesive compositions using surface analysis and characterization methods. The following tasks have been identified:

- Perform a literature study on adhesive bonding with particular emphasis on hybrid joining and hybrid adhesives
- Draft a test plan to include the following steps: characterization methods to analyse substrate and joint surfaces, specimen manufacturing procedure, mechanical joint tests
- Manufacture of test specimens and execute the test plan
- Analyse and discuss the results in a written scientific report

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