Natural Fibre Reinforced Composites

Due to an increased environmental awareness and the fact that fossil fuels are a finite resource, interest in natural fibre reinforced composites (NFCs) has increased rapidly over the last years.

NFCs consist of two main components: natural fibres and a matrix made of a bio- or conventional polymer. Depending on the manufacturing process and application varying additives are added to the composite. NFCs have several advantages over conventional fossil fuel based materials:

- unlimited availability
- CO2 neutral and health friendly manufacturing process
- good recycling or composting characteristics
- good mechanical characteristics: lightweight and stiff
- good thermal and acoustic isolation properties

All of these characteristics make NFCs interesting for a wide field of applications like the automotive, the sports and the construction industry but also for everyday objects and electronic components.

The Material

The material that will be investigated is a thermoplastic NFC. It consists of a brittle Polylactic acid (PLA) matrix reinforced with short Tencel® fibres which are made of cellulose.

Master Thesis Focus

A comprehensive characterization of the Tencel®/PLA material will be performed to acquire its mechanical properties, i.e., strength and stiffness. Experimental data will be collected using the testing equipment in our material characterization lab: tension, compression, bending, and shear tests. For a complete characterization the strain rate dependency of the material and the influence of temperature and humidity on the material behavior is also investigated.

The experimental data will be used to parameterize and calibrate a numerical material model and simulations will be carried out using the FEM code LS-Dyna.

Challenge Statement

Due to the increased interest, lots of new materials were developed recently. For all these materials their characteristic mechanical values need to be determined. Only then it is possible to estimate for which application the particular material is suitable or what has to be improved for the material to be fit for a particular application. Certain industries accept new materials only if a complete experimental and numerical characterization has been conducted.

To promote the use of NFCs, experimental tests and numerical simulations have to be performed which are suitable to comprehensively characterize the particular material.

Requirements and Offers

Expected skills: A good understanding of solid mechanics. It is an advantage if you attended the lectures “Physics of Failure” and “Dynamics of Materials”.

We offer a 40 hours/month employment.

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