Development of Mechanical Testing Procedures for Thermoplastic Composite Tapes

Maissaloun El-Jakl (M.el-jakl@tudelft.nl), Clemens Dransfeld (C.A.Dransfeld@tudelft.nl)

Introduction

Unidirectional fibre-reinforced polymers (FRPs) are widely used in high-performance industries such as aerospace, marine, and automotive due to their high strength, stiffness, and low weight. Thermoplastic polymers offer key advantages over thermosets, including recyclability, reprocessability, and improved sustainability. However, their high melt viscosity makes direct impregnation of fibre bundles challenging.

This research is conducted within the Processing of Advanced Architectured Materials (PAAM) Research Group, which focuses on structure–processing–property relationships in lightweight materials. The group aims to develop advanced materials for high-performance applications. A key manufacturing route within the group is tapeline production, particularly melt impregnation, which serves as a foundation for continuous composite tape fabrication.

Aim

Mechanical Characterization of Thermoplastic Composite Tapes

The reliable mechanical characterization of thermoplastic composite tapes remains a challenge due to their geometry. Existing standardized testing methods are primarily developed for fully consolidated laminates and do not adequately capture the intrinsic behaviour of individual tapes. As a result, there is currently no consistent framework to evaluate mechanical tape quality.

Research Question

How can mechanical testing methods be designed to accurately capture the intrinsic strength and toughness of individual thermoplastic composite tapes, and what insights do these results provide on microstructure–property relationships?

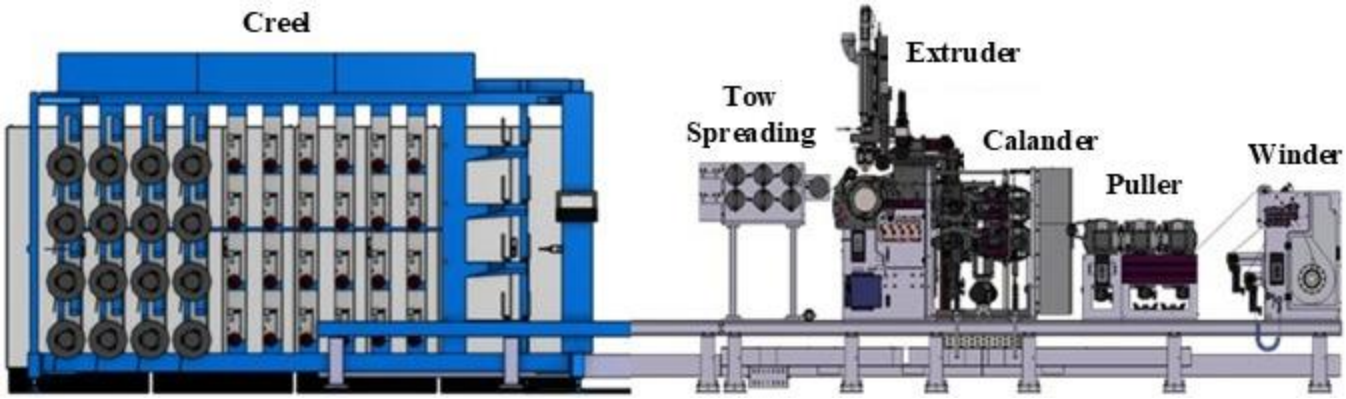
Activities & Expectations

To reach the aim of the research study, the main activities are listed below.

- **Develop** and adapt mechanical testing methods for unidirectional thermoplastic composite tapes
- **Evaluate** mechanical properties such as strength and toughness in the direction of fibers under controlled conditions
- **Assess** test reliability and relate results to microstructural features.

This study will **enrich your understanding of thermoplastic composite processing**, mechanical testing, and data analysis, with a focus on linking microstructure to material performance.

A strong **motivation to learn** is essential. Prior knowledge of composite materials is beneficial but not required.



Manufacturing process: Thermoplastic tapeline and its melt impregnation configuration

This work is suitable for Master students. Sounds interesting? Please get in touch!