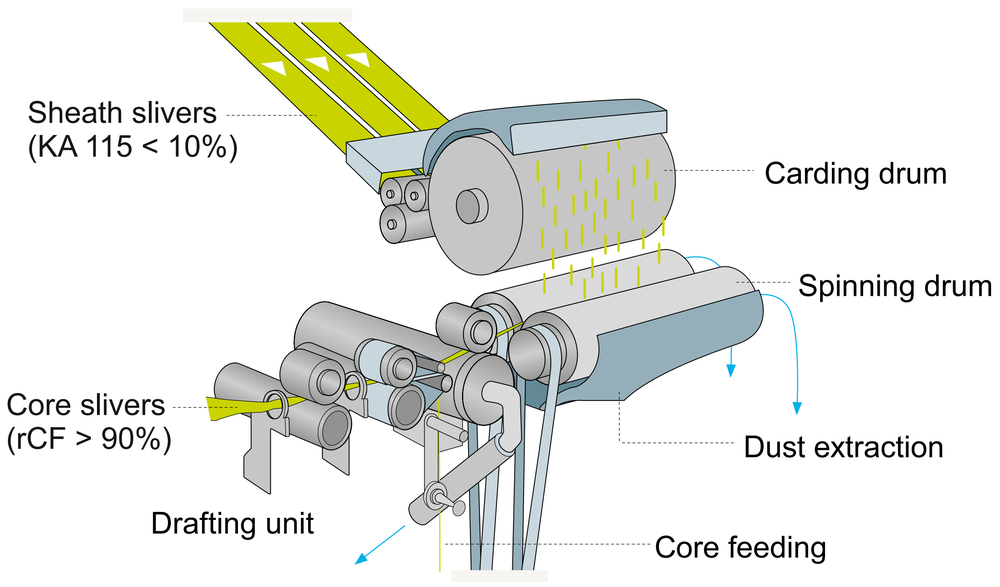
TECHNISCHE UNIVERSITÄT DRESDEN

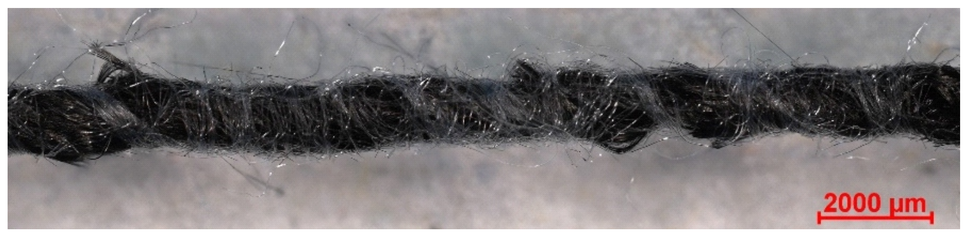
ITM LEADING IN FIBRE & TEXTILE TECHNOLOGY
The Research Institute of University of Excellence

Faculty of Mechanical Science and Engineering Institute of Textile Machinery and High Performance Material Technology

MODELING AND SIMULATION OF DEFORMATION OF TEXTILES MADE FROM RECYCLED CARBON FIBERS



DREF-3000 | © Rieter Manual of Spinning



Manufactured DREF yarn

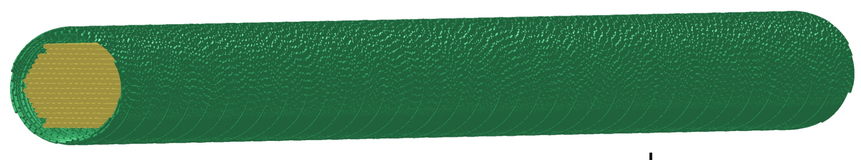
Finite element model of DREF yarn

Objective

The spinning of recycled carbon fibres (rCF) in the friction spinning process enables the production of yarns with high extensibility compared to continuous filament yarns. The high carbon fibre content also makes them suitable for use in thermoset applications. The interactions between the deformation behaviour and various process parameters, especially for friction spun yarns made of carbon fibres, are unknown. The objective is to apply finite element models to investigate the influence of process parameters on yarn behavior.

Methods

- DREF yarns consisting of a sheath (co-polyamide; length 100 mm; < 10 wt%) and one core (rCF; length 60 mm; > 90 wt%) are manufactured while varying process parameters
- Yarn and fiber geometries are analysed from microscopic images
- Geometric models are generated based on the collected geometric properties
- Finite element simulations are carried out with the geometries using a two-step-simulation approach
- The deformation behavior of the models under tensile loading is analyzed

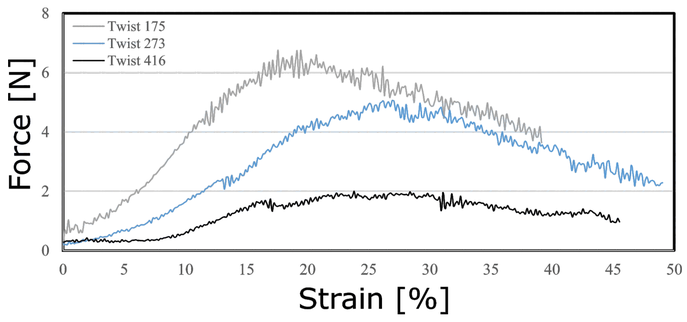


initial fiber geometry

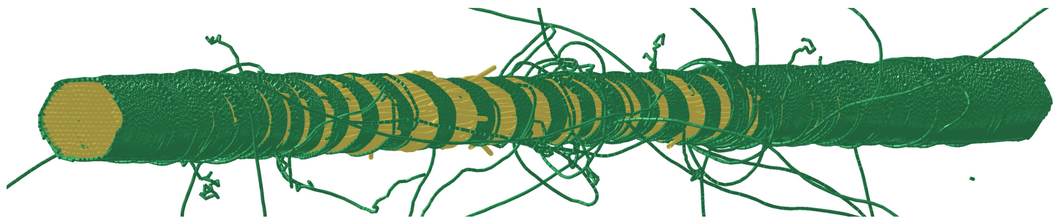
After-compression geometry

Results

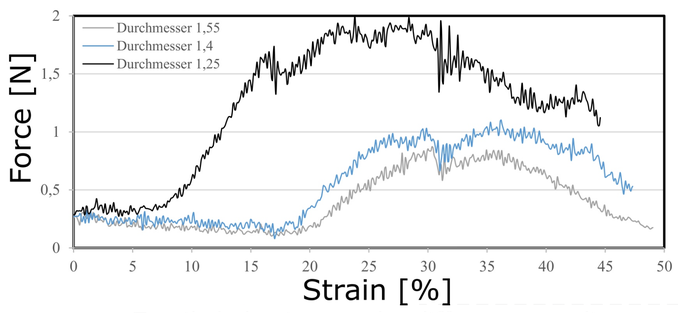
- Fiber geometries close to the yarn geometry are achieved
- Frictional contact occuring during fiber-fiber-interactions in combination with yarn compression identified as main influence on yarn deformation
- Higher compression leads to a higher maximum forces at lower strains



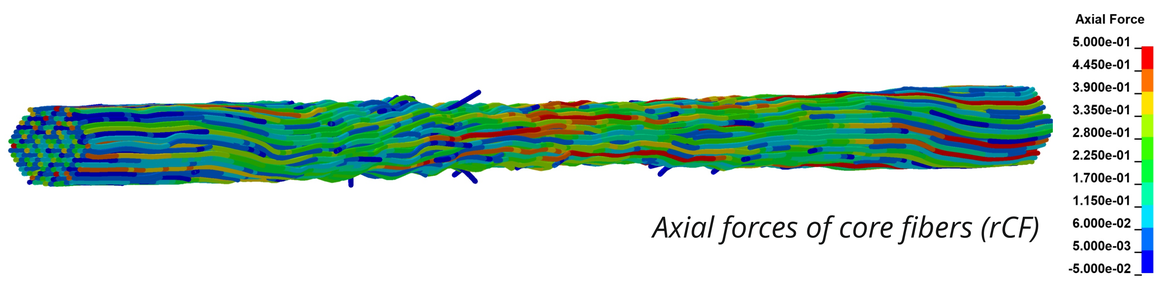
Tensile behaviour under different yarn twist



Deformed geometry



Tensile behaviour under different yarn diameters



Axial forces of core fibers (rCF)

Funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – 442070201 (GE2525/5, CH174/55)

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