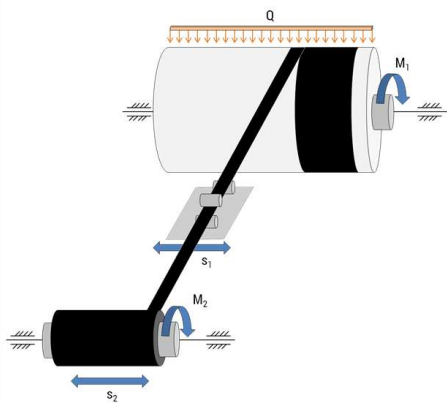


# Torque-Fiber-Winding(TFW)-Process

## Application-specific, textile-based unidirectional (UD)-Prepreg-Materials

PROCESS CHAIN



### Equipment technology / TFW-Process

- Uniform fibre arrangement and alignment without gaps on **dry matrix material** through precisely controlled fibre spreading & placement
- Immobilization of fibres on dry thermoplastic non-woven fabric (=matrix) by heat induced fibre-matrix-surface adhesion and joining
- Adjustable fibre volume and weight content
- Adjustable matrix and fibre material selection
- Reproducible composite quality and mechanical properties by processing of one roving at a time
- Flexible for varying production requirements and composite composition

**Production of application-oriented and load bearing-optimized lightweight laminates: Selectable laminate dimensions (L x W x H) and fibre-matrix material composition**

### INNOVATION

- Textile-based fibre-reinforced composite components
- Minimal material use
- Customized UD-Prepreg-Fabrication
- Mild fibre processing conditions
- Reinforcement fibre roving spread by factor 2 to 2,5
- Homogeneous, fully consolidated laminates with < 0,1mm single layer thickness

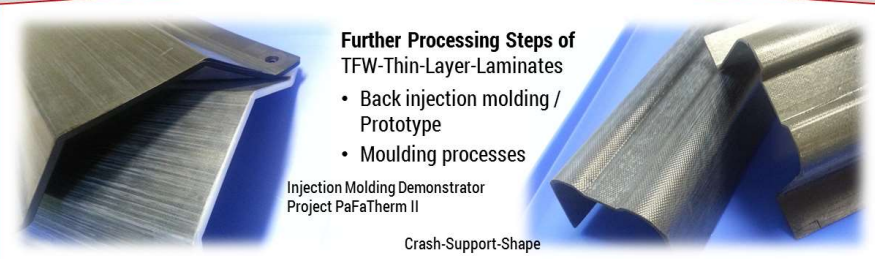
### EFFECTIVENESS & EFFICIENCY

- Simple production with short cycle times
- Minimal production area needed
- Minimal roving change up time
- Energy efficient through temporary heat input for initial fibre-matrix joining
- Output-customized and scalable production modules
- Production of large area laminates, adjustable areal weight

- Production of large area application-oriented laminates,
- Subsequent processing to endless-fibre-reinforced lightweight components by large scale production

### SUSTAINABILITY

- Maximal material utilization, minimal material waste
- Process compatibility to other known composite materials for hybrid components
- User friendly process and systems engineering

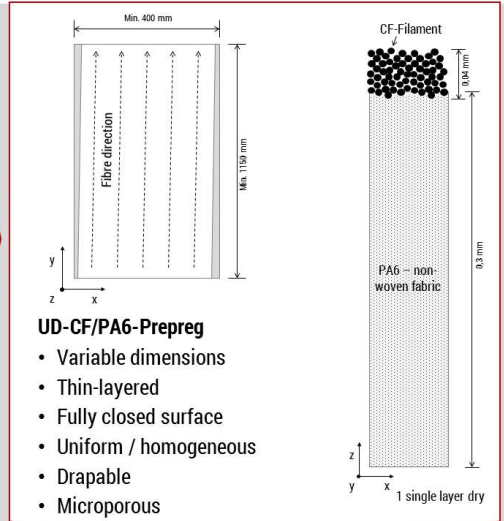


**Further Processing Steps of TFW-Thin-Layer-Laminates**

- Back injection molding / Prototype
- Moulding processes

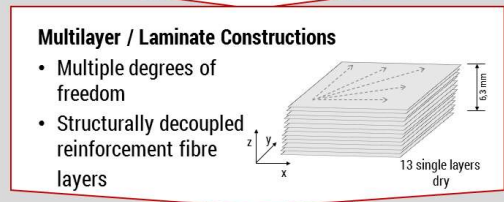
Injection Molding Demonstrator  
 Project PaFaTherm II

Crash-Support-Shape



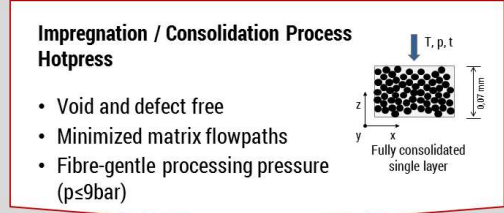
**UD-CF/PA6-Prepreg**

- Variable dimensions
- Thin-layered
- Fully closed surface
- Uniform / homogeneous
- Drapable
- Microporous



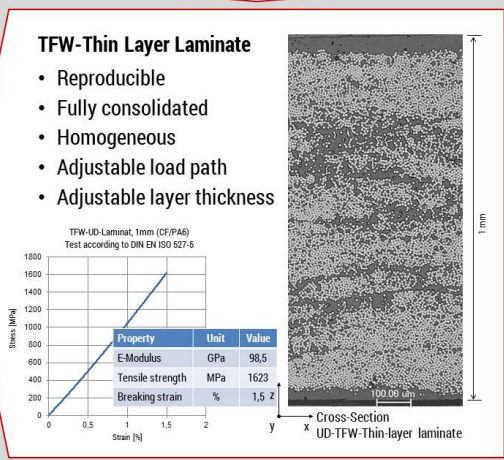
**Multilayer / Laminate Constructions**

- Multiple degrees of freedom
- Structurally decoupled reinforcement fibre layers



**Impregnation / Consolidation Process Hotpress**

- Void and defect free
- Minimized matrix flowpaths
- Fibre-gentle processing pressure (p≤9bar)



**TFW-Thin Layer Laminate**

- Reproducible
- Fully consolidated
- Homogeneous
- Adjustable load path
- Adjustable layer thickness

Property	Unit	Value
E-Modulus	GPa	98,5
Tensile strength	MPa	1623
Breaking strain	%	1,5

TFW-UD-Laminat, 1mm (CF/PA6)  
 Test according to DIN EN ISO 527-5

Sheet [MPa] vs Strain [%] graph showing a linear relationship up to 1.5% strain.

CONTACT

