



Automated Production of Thermoplastic Composites

Using AFPT's Laser-Assisted Deposition Technology

Lucas Ciccarelli, M.Sc.

AFPT GmbH, Business Development Department



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Automation of Production

Automation of Standard Products

Automation of One-Off Productions

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Automation of Production

Automation of Standard Products

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AFPT: The Company...

5

Machines in our application center

> 300

Miles of tape material processed in a year

... offers automated solutions for the (mass) production of ***thermoplastic*** composite structures using ***laser-assisted*** deposition technology since 2003 .



10

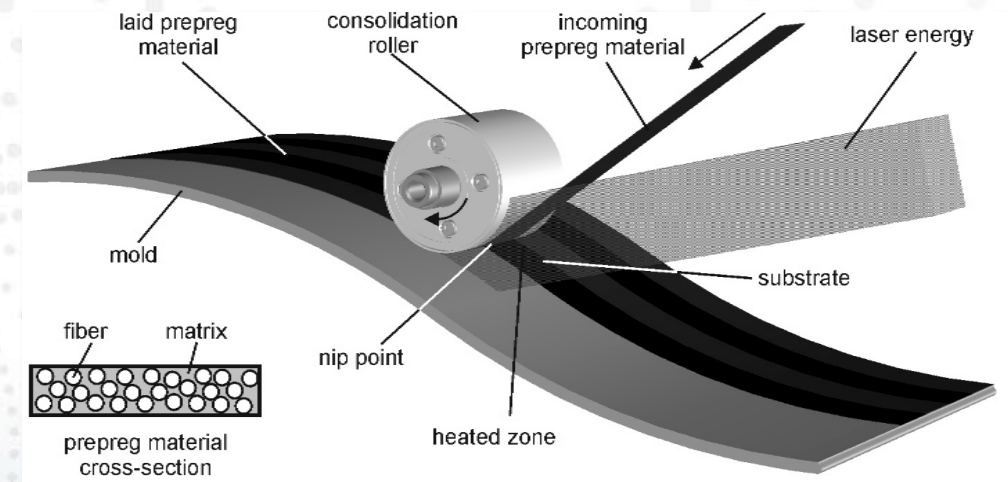
Open & Completed Public research projects

> 50

Deposition tools integrated in industry and academia

The Laser-Assisted Tape Winding / Placement (LATW/LATP) Process

- A placement head positions the pre-impregnated tapes, on the required mold or mandrel
- The thermoplastic pre-impregnated tape material is heated by a laser to the processing temperature
- A fast control system maintains the desired parameters such as process temperature, consolidation pressure and tape tension.
- The LATW process results in a composite component which is ready to use (**in-situ consolidation**)
- All process parameters are logged to be used for quality assurance.



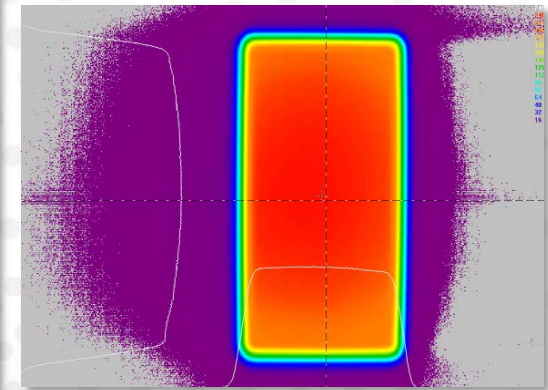
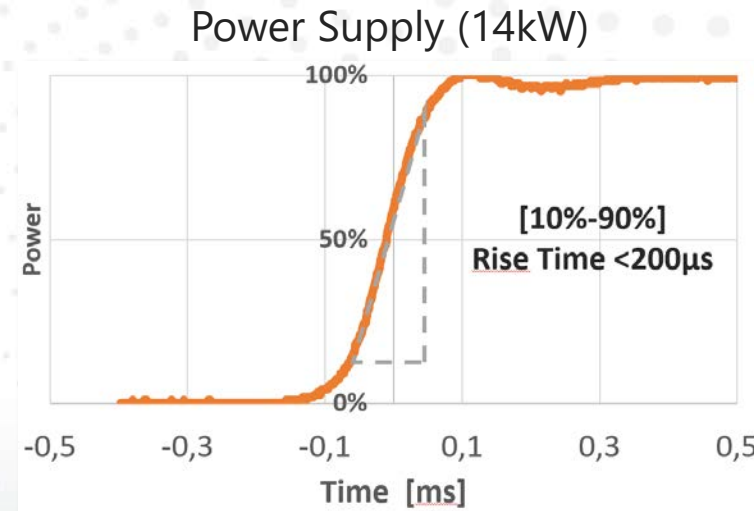
The Heat Source - Laser

Advantages

- Laser response time is in the range of milliseconds (1 ms -2 ms)
- Homogeneous intensity distribution over the laser spot
- Non-contact temperature measurement of the heated prepreg
- Low operating costs

Disadvantages

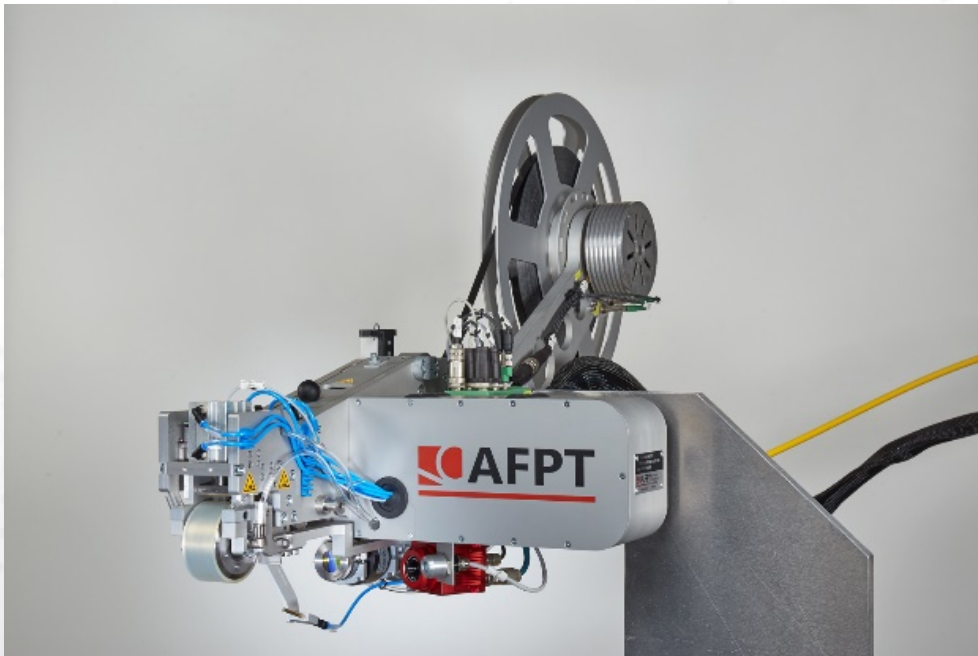
- Safety-enclosure required



Our Business

Production Systems

Supply and Integration of
Automated, Industrial Equipment

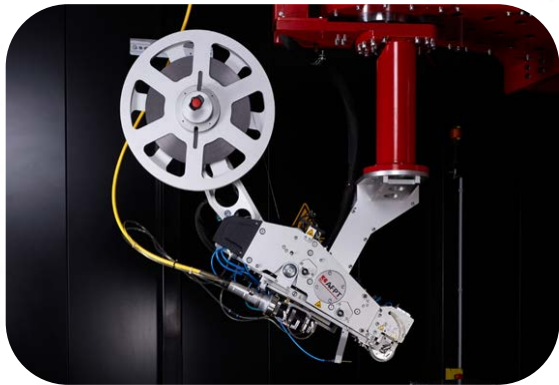


Application Center

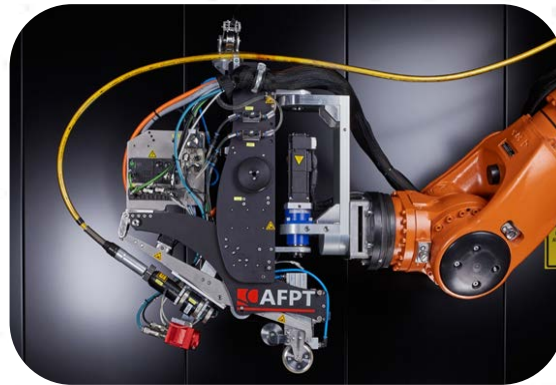
Process Development, Process
Simulation and Serial Production



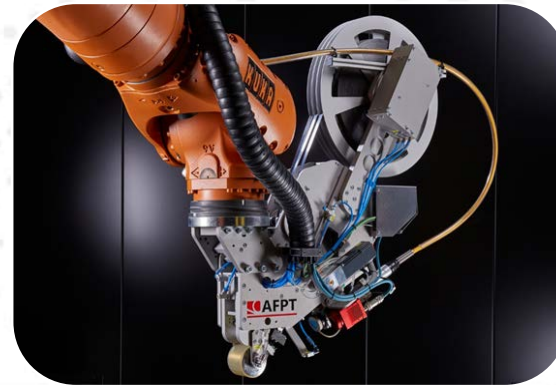
Different Deposition Tools for Different Applications



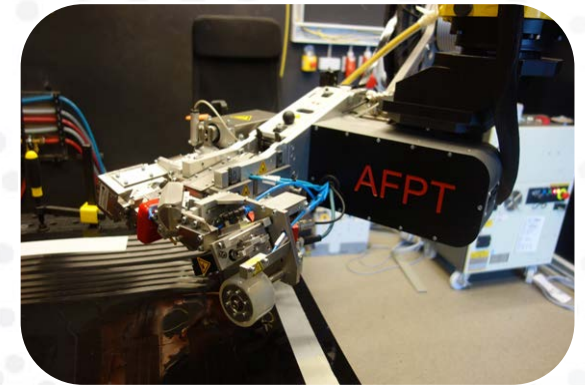
Single-Tape
Deposition



Vessel Winding

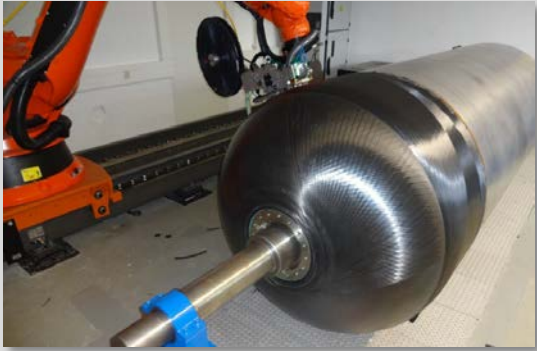


Multi Tape
Deposition



Special Applications

Examples of Integrated Systems



R&D Systems

Industrial Systems



Company Introduction and Technology

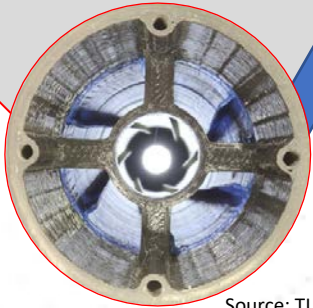
Automation of Production

Automation of Standard Products

Automation of One-Off Products

Component Production Potential

3D-Printed
(Internally)



Source: TUM

Mandrel
Plastic Liner
Plastic Sheet
Metal Sheet

LATW Process



Over-Molded



Source: Mitsui

3D-Printed
(Externally)



Cut



Bent



Machined

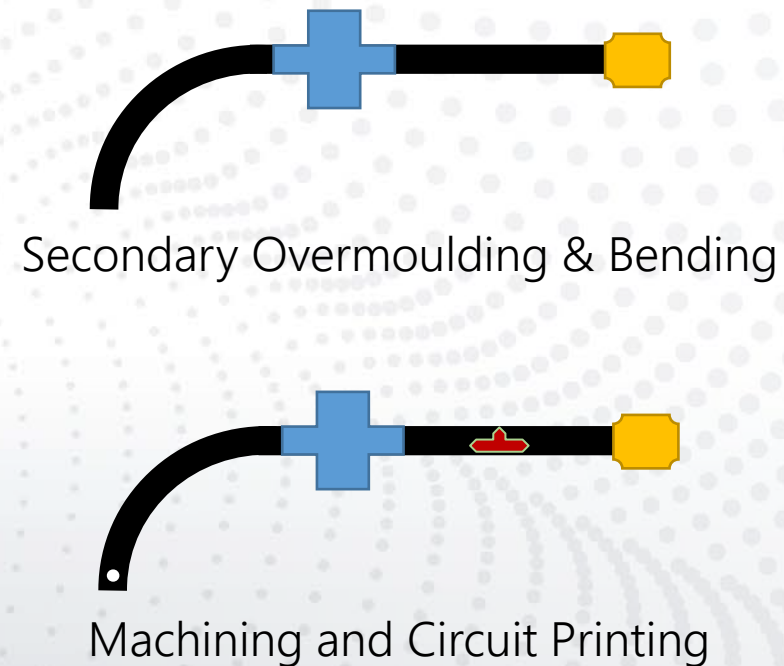


Automated Production for High Value CFR Thermoplastic Products

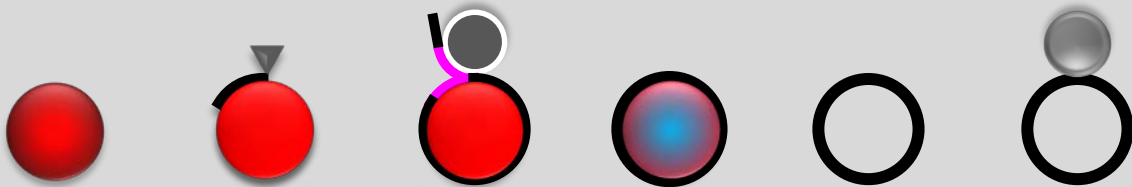
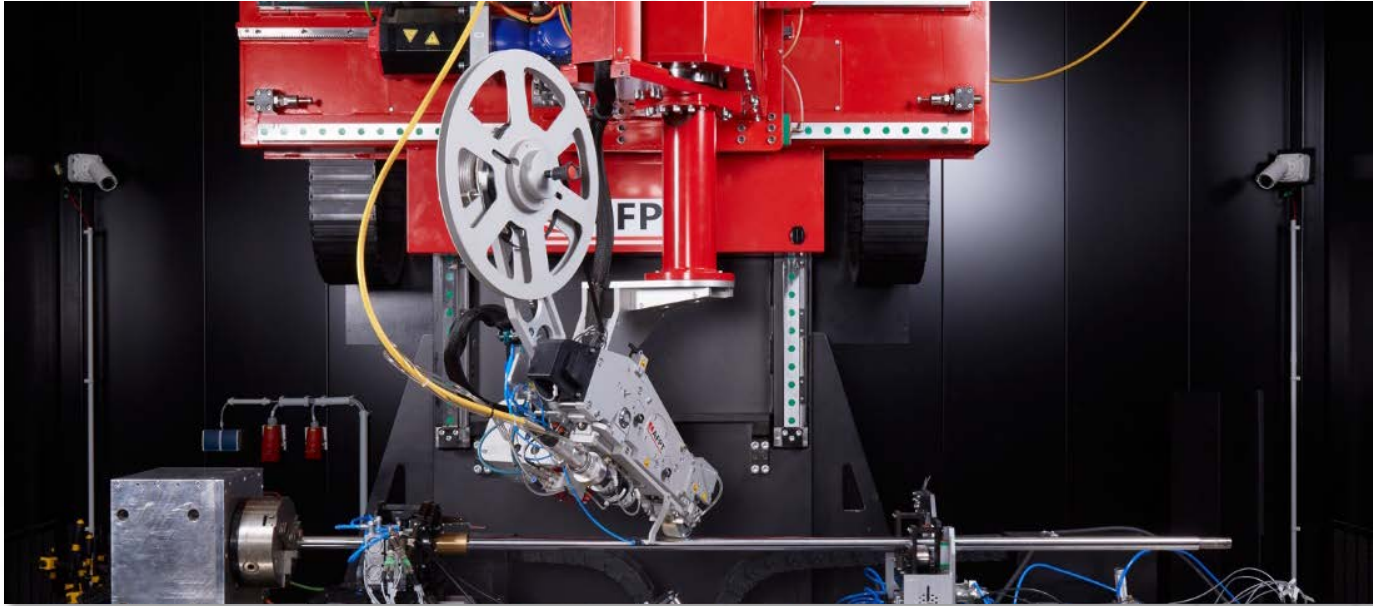
LATW Machine



Secondary Steps



Automated Production Process



Company Introduction and Technology

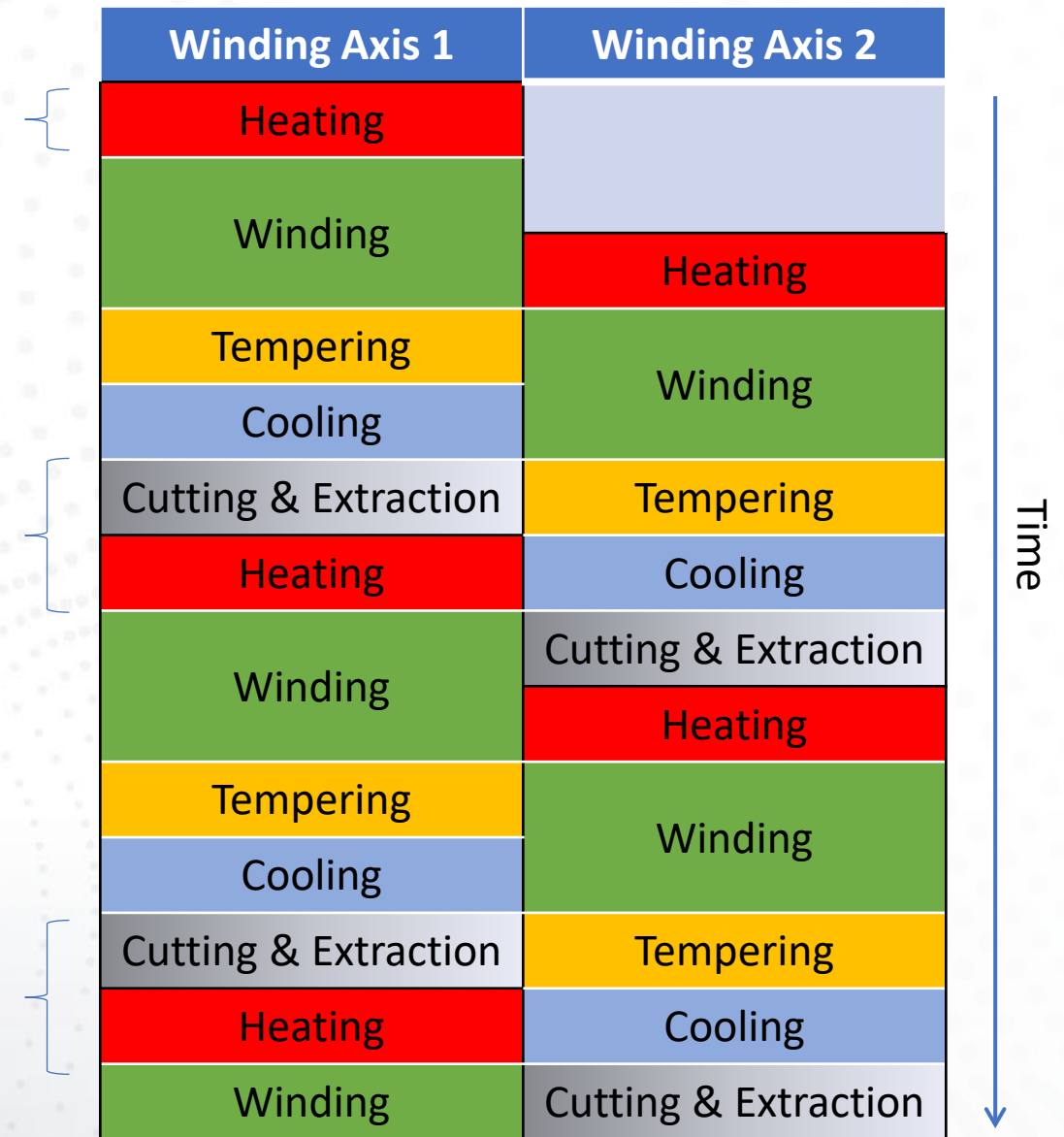
Automation of Production

Automation of Standard Products

Automation of One-Off Products

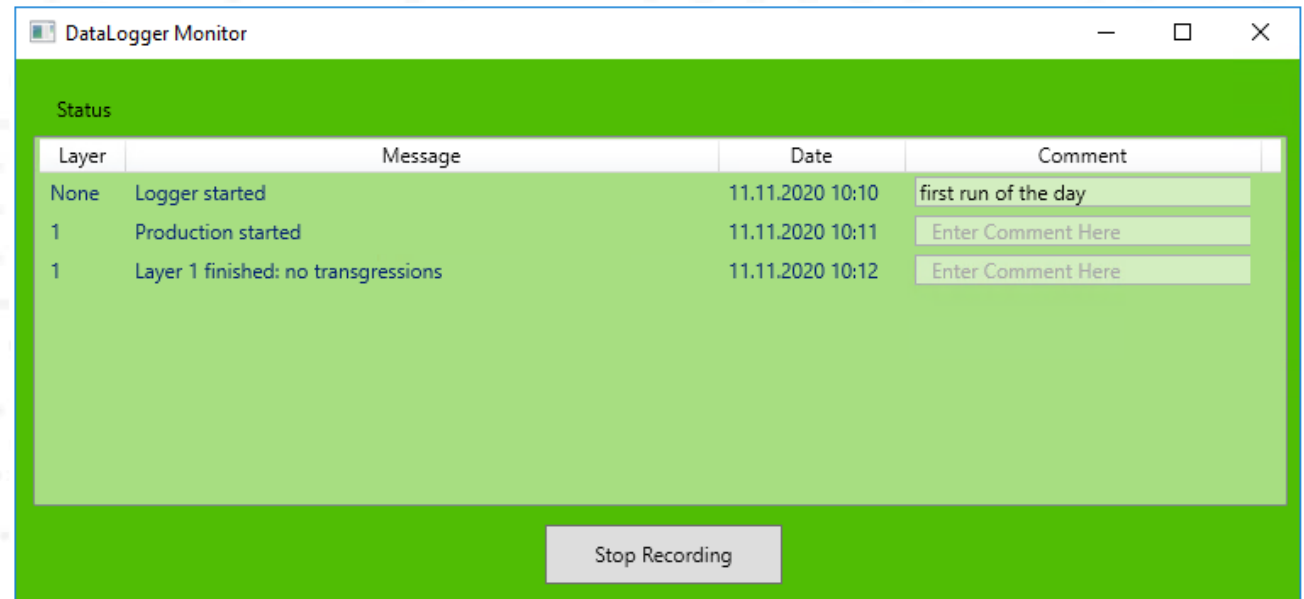
Optimising Automated Production

- Goal: Reduce down time of primary value-add (Winding Head)
- Based part design and requirements
 - Number of layers
 - Number of cuts
 - Crystallinity
- Extra automation steps that don't impact primary machine
 - Code Etching
 - Transport



Automated Feedback for Operator

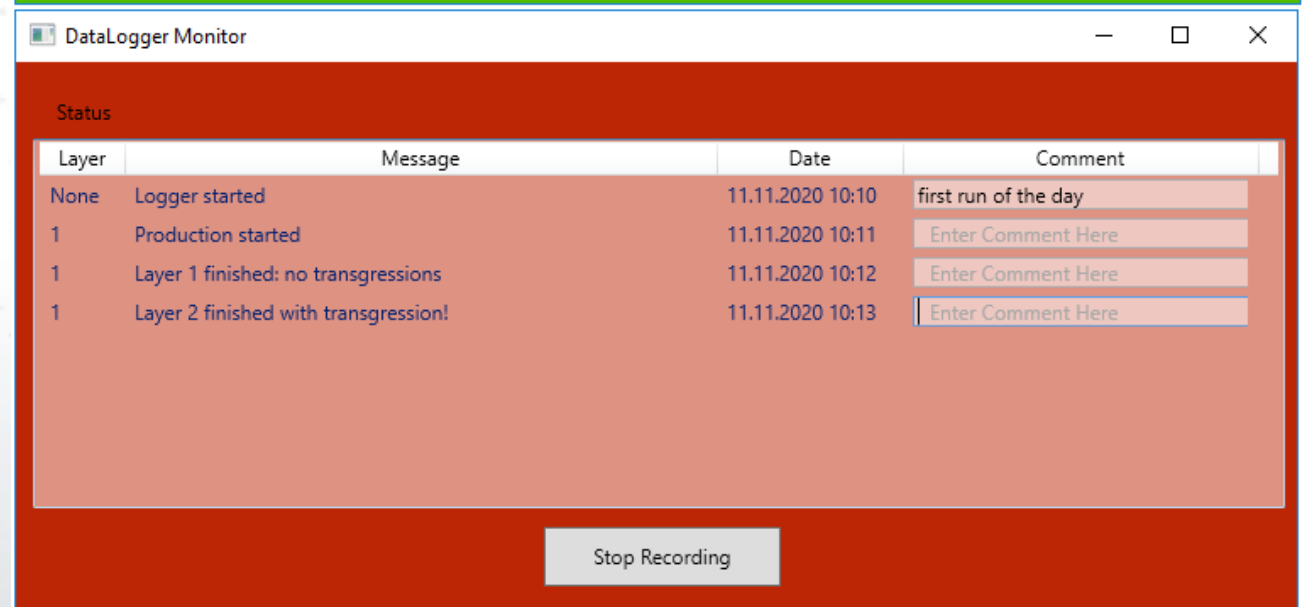
- Direct feedback of process quality during the production
- Can be set-up to rank or count defects
- Time and material saved with on-line quality monitoring
- Negative trends stopped before influencing multiple components



The screenshot shows the 'DataLogger Monitor' window with a green background. It features a table with the following data:

Layer	Message	Date	Comment
None	Logger started	11.11.2020 10:10	first run of the day
1	Production started	11.11.2020 10:11	Enter Comment Here
1	Layer 1 finished: no transgressions	11.11.2020 10:12	Enter Comment Here

A 'Stop Recording' button is located at the bottom center of the window.



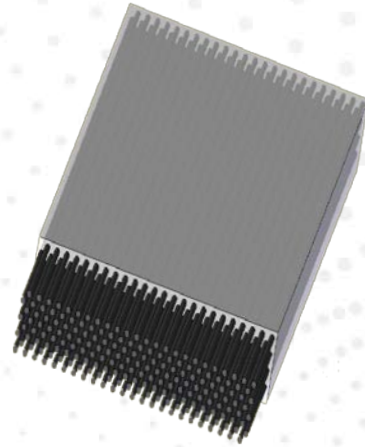
The screenshot shows the 'DataLogger Monitor' window with a red background. It features a table with the following data:

Layer	Message	Date	Comment
None	Logger started	11.11.2020 10:10	first run of the day
1	Production started	11.11.2020 10:11	Enter Comment Here
1	Layer 1 finished: no transgressions	11.11.2020 10:12	Enter Comment Here
1	Layer 2 finished with transgression!	11.11.2020 10:13	Enter Comment Here

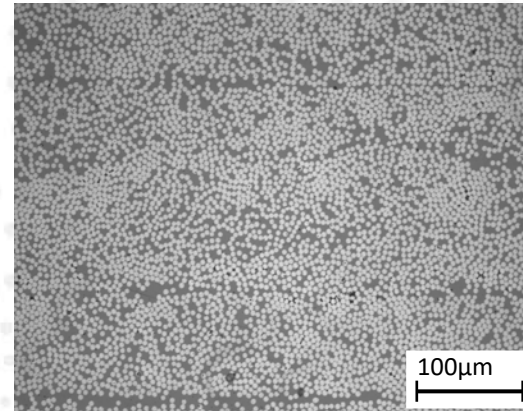
A 'Stop Recording' button is located at the bottom center of the window.

Material Consolidation

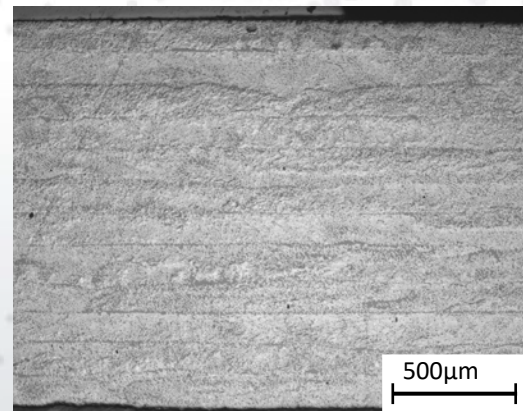
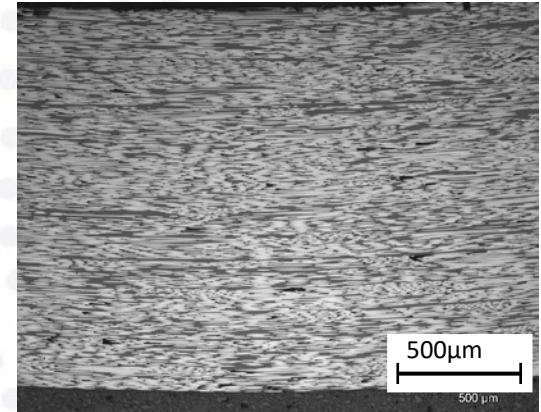
- Pre-impregnated tapes, consisting of unidirectional fibers which are responsible for high strength and stiffness of the composite material
- Controlled heating process generates constant high-quality laminates
- Process keep the properties of the prepreg material
- Void content is determined by the tape material
- Process do not generate voids in the laminate



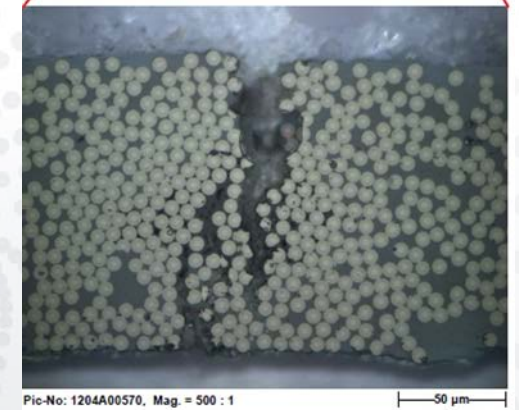
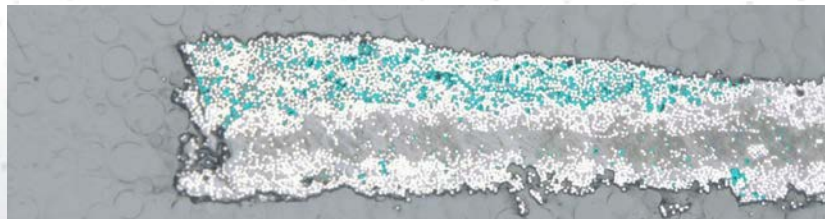
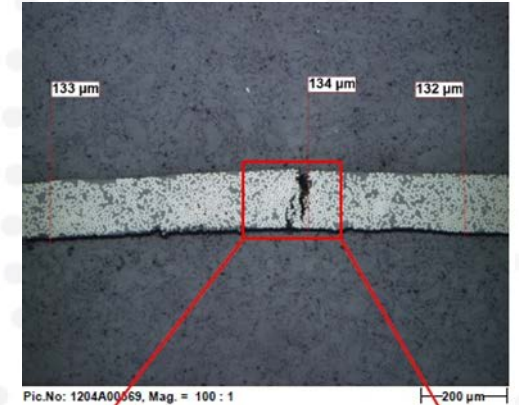
Perpendicular Cross Section



Longitudinal Grinding



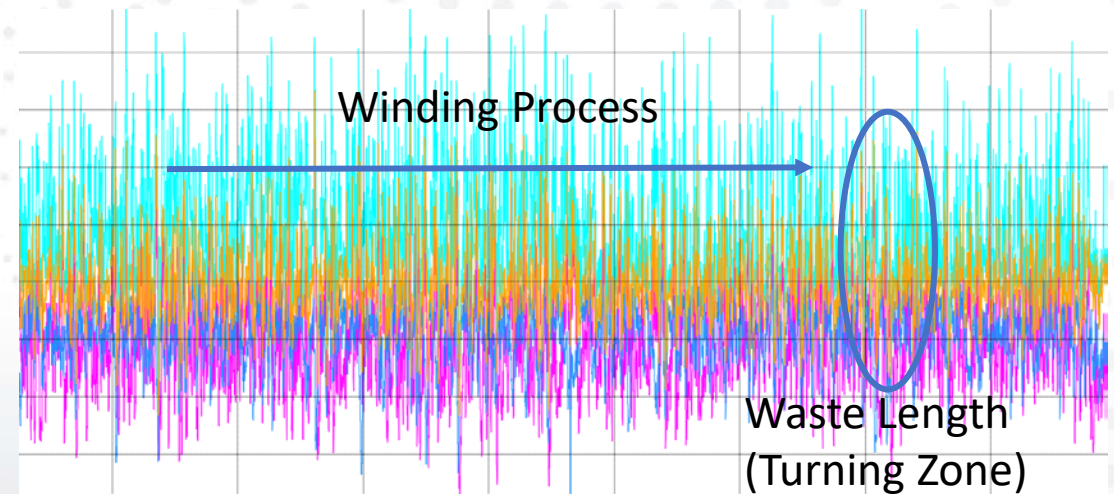
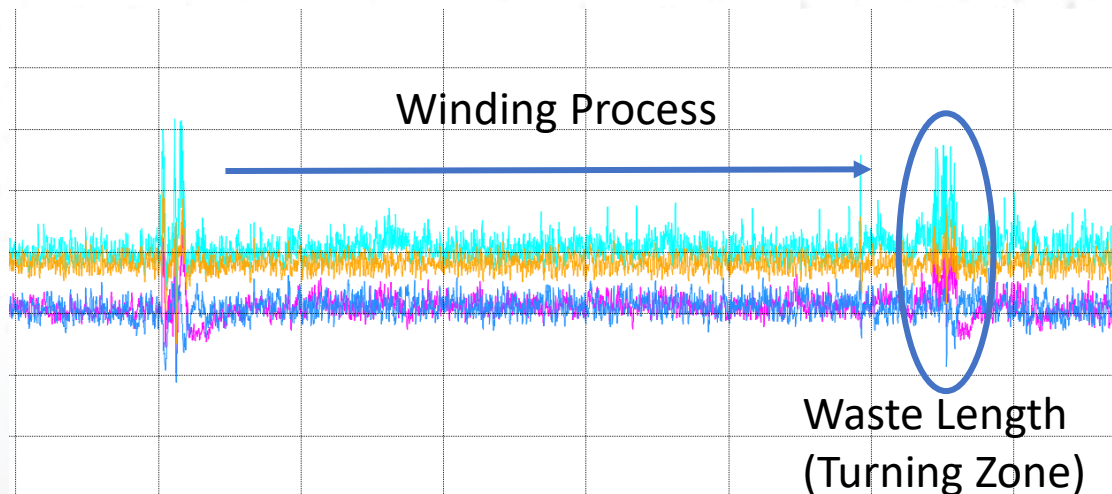
Material Quality Issues



Material Quality Influences on the Process

Good Batch

Questionable batch

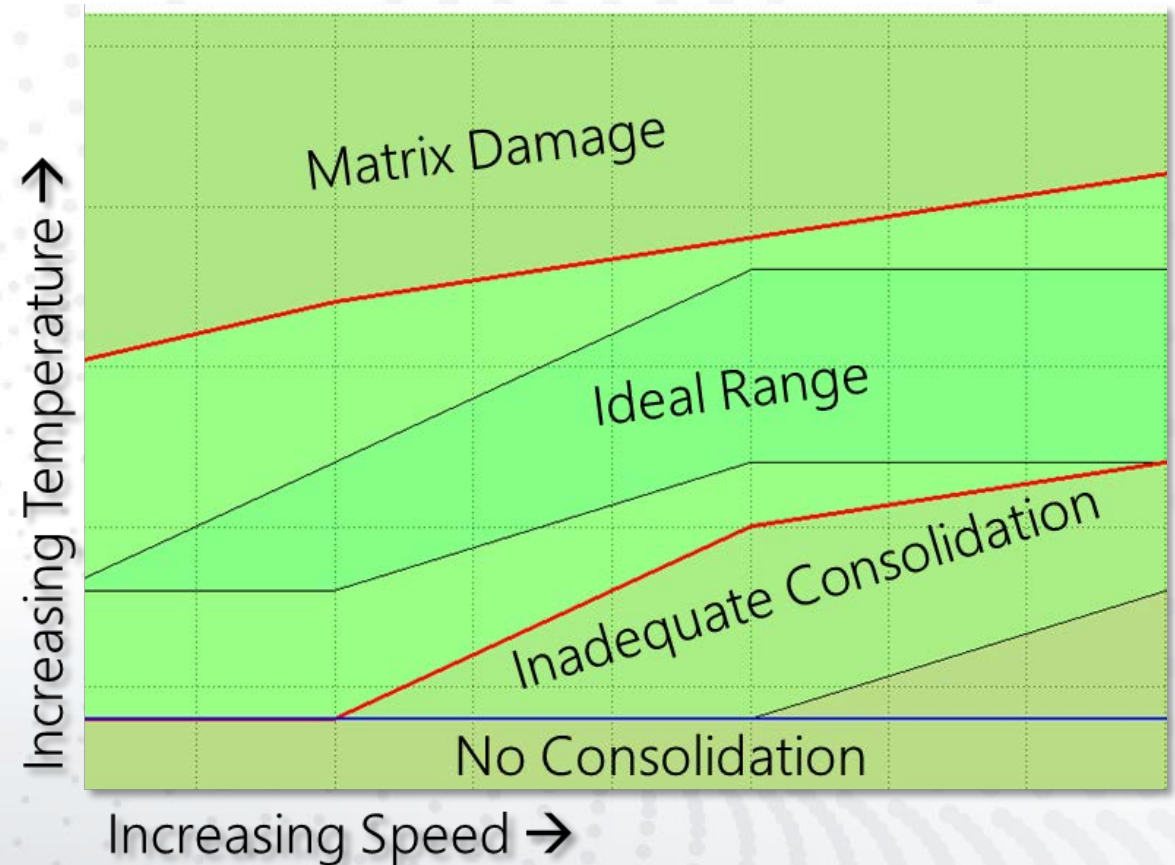


Comparable Parts, Same Material, Different Material Batch

Optimising Speed To Get The Most Out Of The Machine

Speed & Temperature

- Thermoplastic processing can reach speeds of at least 90 m/min in hoop winding
 - Limiting factor robot kinematic (dynamics)
- Each tape has it's own 'sweet spot'
- Combination of speed and temperature can create optimal balance of cycle time and quality



Company Introduction and Technology

Automation of Production

Automation of Standard Products

Automation of One-Off Products

The Alformet Way

A business model taking general CFR TP availability to the next level

- Categorization of Component Classes
- Standardization of Process Flows
 - Plug-and-play ERP
- Automation of Process Flows
 - Lean Business Model based on QRM Principles
 - Interface Customer Wish to Machine
- Automation of Equipment
- Tight Supplier Relations



First Simplification of CFR TP Ordering

The screenshot shows the Alformet website interface. At the top is a dark navigation bar with the Alformet logo and menu items: HOME, ABOUT, OUR EARTH, APPLICATIONS, TUBES, COMPOSITE, BLOGS, and CONTACT. Below the navigation bar, the page is divided into two main sections. The left section, titled 'Create your own tube', contains introductory text about Alformet's services and a list of required information for a tube order. The right section, titled 'Price calculation tool', features a form with input fields for Name, E-mail address, Inner Diameter, Wall Thickness, Length of tube, Amount, Material, Load condition, and Remarks. At the bottom of the form are two buttons: 'Customized solution request' and 'Calculate and send result'. The source 'Source: alformet.com' is noted at the bottom right of the screenshot.

alformet HOME ABOUT OUR EARTH APPLICATIONS TUBES COMPOSITE BLOGS CONTACT

Create your own tube

Alformet believes in easy access to the CFR Thermoplastic tube technology to support your business and overcome challenges. Like when you want to introduce new products (fast prototyping) or when you need parts to complete your model for testing or experimenting. Whatever the background of your need, Alformet offers you a number of standard inner diameters to build tubes with fast delivery. You can find these options in the form on the right.

The required information consists of:

- Dimensions and amount, noting that the wall thickness is indicative due to tolerance on the applied tape thickness;
- UD Tape/Material type: in the order of price level (low to high):
 - **PP**: average performance for specific applications
 - **PA6**: good performance and very versatile
 - **PC**: high performance with moderate price level
 - **PEEK**: excellent performance with high price level
- Load condition:
 - **Bending**: fibres oriented to resist deflection
 - **Torsion**: fibres designed to take torsional loads
 - **Internal pressure**: reinforcement designed to take up internal pressure
 - **Combined**: combination of the different loads in one product

Fill in the form and you will receive our proposal by e-mail without any obligation.

If you need a customized solution, please contact us using the button below.

Price calculation tool

Name

E-mail address

Inner Diameter (in mm) Select one of the options

Wall Thickness (in mm) value between 1 and 5 mm

Length of tube (in mm) value between 10 and 2250 mm

Amount number of tubes

Material select UD tape

Load condition select load condition

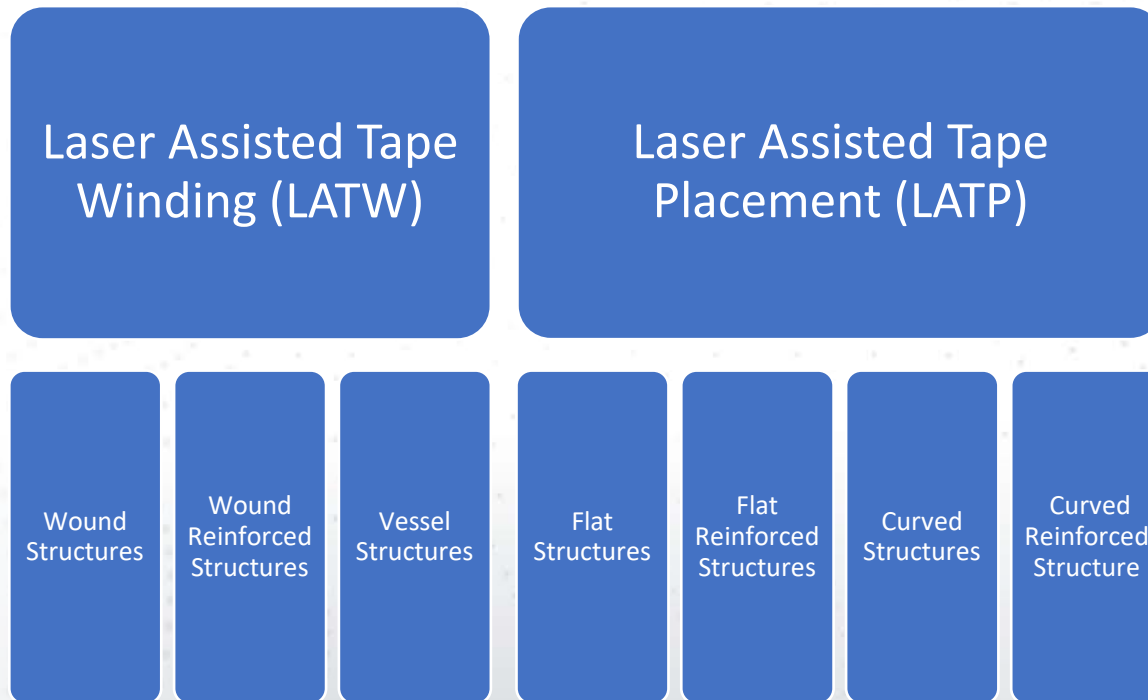
Remarks Please add questions or remarks here (max. 3 lines)

Customized solution request → Calculate and send result →

Source: alformet.com

Organization of Product Types

Hierarchy Based On Process



Online Shop (Beta)

Wound CFR TP Prototype
Continuous Fibre Reinforced Thermoplastic Tube

Shape: Round Cross Section
Axial Symmetry: Constant Cross Section
Laminar Symmetry: Constant Thickness
Priority: Prioritize Laminar Layup
Quality Assurance: No Reporting

SHAPE

ROUND CROSS SECTION SQUARE CROSS SECTION COMPLEX SHAPE

AXIAL SYMMETRY

CONSTANT CROSS SECTION VARIABLE CROSS SECTION

LAMINAR SYMMETRY

CONSTANT THICKNESS VARIABLE THICKNESS

PRIORITY

PRIORITIZE LAMINATE LAYUP PRIORITIZE LAMINATE THICKNESS

QUALITY ASSURANCE

NO REPORTING BASIC REPORTING ADVANCED REPORTING

TAPE MATERIAL

PA12-CF

DIMENSION [MM]

Inner

DIMENSION [MM]

Outer

DIMENSION [MM]

Usable Length

Thank you for your attention!

Questions? Please contact us:

AFPT GmbH
Trinkbornstraße 10
56281 Dörth, Germany

lucas.ciccarelli@afpt.de / sales@afpt.de

+49 6747 95 01 85 32

<https://www.afpt.de>

<https://www.linkedin.com/company/afpt-gmbh/>