Technical Specifications

Winding Machine

- Dry and wet winding process with fiber rovings
- 4 CNC-controlled axes
- Impregnating bath and heated mandrels
- Winding length max. 1400 mm, diameter max. 700 mm
- Fiber coils max. 6
- Thread tension up to 50 N

Vacuum Lamination Hot Press

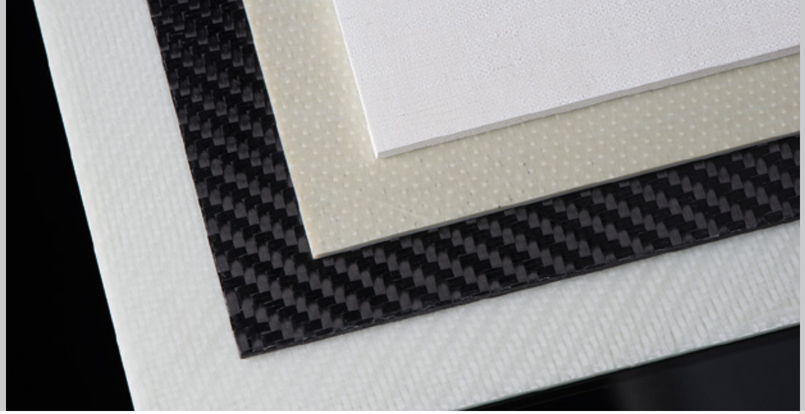
- Processing of dry and wet laminates prepregs and short fiber mixtures
- Evacuable press chamber
- Path and pressure controllable
- Adjustable pressure p = 2 - 400 kN and T = RT - 400° C
- Stampable surface 600 mm x 400 mm

Prepreg Machine

- Continuous roll-to-roll process
- Coating of 2D-fabrics and UD-tapes
- Application process: Foulard, squeegee, powder spreader
- Working width (width of the fabric) up to 600 mm

Machining Center

- Precision machining of metals and composite materials
- 5-axis simultaneous machining
- Part sizes up to Ø 640 mm, 500 mm height and max. 1000 kg
- 3D component measurement in the machine



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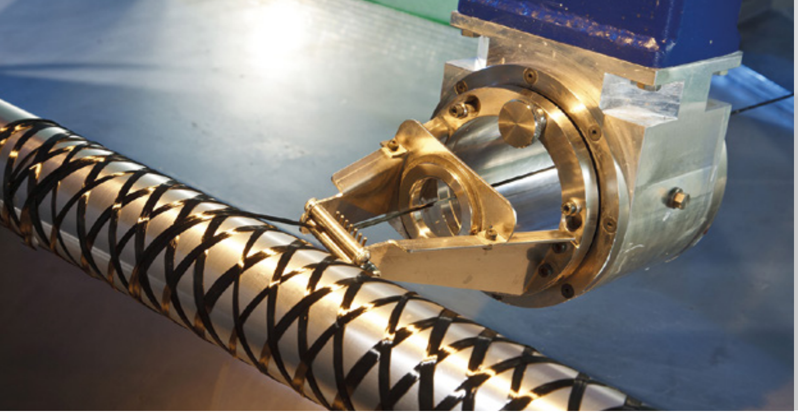
Prototypes and Components Made of Fiber Composites



Green Manufacturing of Fiber Composite Components

The performance of components made of composite materials is determined by the fiber and the matrix composition. These are defined already in the green manufacturing stage.

Fiber preforms are used as short fibers, textile 2D- and 3D- semi-finished products or as wet prepregs. The prepreg technology permits an impregnation of textile semi-finished products with different matrices. Polymer matrices are usually thermoplastics or duroplasts, which can also be provided with filler particles. For oxide composite ceramics slips are designed according to customer requirements.

The microstructural design of the components is largely determined by factors such as fiber volume fraction, fiber matrix distribution and fiber orientation. The shape and the complete crosslinking of the polymers are carried out in pressing, winding or laminating processes followed by thermal treatment. For an optimum selection of the experimental parameters and experimental procedure the thermal behavior and the rheological properties of the polymers must be determined.

Initially in many cases a mold design is necessary for a cost-effective production of components in final contour. The tool design is carried out based on the component design, taking the machining tolerances into consideration.

Thermal Treatment, Joining Technology and Final Machining

The matrix of the components must be fully cured before further heat treatment steps are carried out at high temperatures up to 2400°C. These include the debinding, sintering, pyrolysis, the graphitisation and melt infiltration. The material joinings are usually carried out in situ within a high-temperature step.

The process parameters can be determined by thermal analysis and thermo-optical methods. The high-temperature processes can be made reproducible with the help of a production-integrated quality assurance.

For mechanical intermediate and final processing an ultra-modern 5-axis machining center is available to obtain the desired component geometry. The processing and the tool selection are strongly dependent on the hardness of the material. The cutting parameters can be determined by preliminary tests to design the necessary fixture. The aim is low-stress processing.

A final quality control is possible by using non-destructive testing methods such as thermography, ultrasound and X-ray methods. These imaging techniques allow a statement regarding possible material defects and their extension within the structures.

Prototypes and Small-Series Production

Material and fiber-based solutions for thermally and mechanically highly stressed lightweight structures can be offered depending on customer requirements. The production of components takes place in a closed and quality-assured process chain. All process steps and parameters are logged.

If the laboratory process is viable the technique can be transferred to pilot plant scale for the production of small series. If the process is sufficiently stable and reproducible, a technology transfer to industry is possible.

Typically there is a technical drawing first. We advise the customer and together we can re-engineer the design by FE modelling. Usually a thermo-mechanical composite design is needed for prototypes to reach a load-compatible construction.

Geometrically simple components with an integral design can be made of thick plates or tubes by working out the final contour of the solid material. If the components are geometrically complex, they are firmly bonded and form-fitted together through laser technology or high temperature furnaces.