WOOD AND NATURAL FIBER REINFORCED COMPOSITES

Development and material characterization

The Fraunhofer Institute for Wood Research, Wilhelm-Klauditz-Institut WKI has extensive expertise in the development and characterization of compounds and products based on lignocellulose, like wood, natural fibers such as hemp and flax, agricultural residues, and thermoplastics. Applications are, for example, in building materials, furniture, automotive and products for logistics.

Wood and natural fiber reinforced composites are processed using various technologies. Extrusion is used for profiles and sheets. Injection molding or compression molding is used for more complex, three-dimensionally shaped parts, and flat-pressing or calendering for films and sheets. The contents of lignocellulosic particles or natural fibers and polymers depend on the application and the processing techniques. In profile extrusion, up to 75 % (by wt.) of lignocellulose is included while in injection-molding, typically, less than 50 % (by wt.) of lignocellulose is used. In compression-molding with thermoplastics or thermosets, up to 90 % of wood and natural fibers are included.

Cellulose-based materials can also be used for 3D printing which offers new opportunities for product design and shape.

For thermoplastic composites, virgin or recycled polymers are used, most often polypropylene (PP), polyethylene (PE), and poly(vinyl chloride) (PVC). Biopolymers such as PE or PP made from sugarcane ethanol, polylactic acid (PLA), and poly(hydroxybutyrate) (PHB) can also be used to process thermoplastic composites.
Processing and testing equipment

- Various equipment for particle size reduction of wood and natural fibers
  - thermomechanical pulping
  - grinding
  - milling
- Particle size analysis
  - vibrational and air-jet sieve analysis
  - “FibreShape”
- Compounding by different methods
  - twin-screw extruder
  - heating-cooling mixer
  - kneading mixer
  - Palltruder®
- Injection-moulding, profile extrusion, hot-pressing
- Filament extrusion for 3D printing
- 3D printing (Ultimaker 2+)
- Test equipment to determine mechanical, physical, optical and thermal properties of compounds and products
- QUV weathering chambers and outdoor weathering facilities

Monitoring quality

Fraunhofer WKI is recognized by the Quality Association for Wood-based Panels (Qualitätsgemeinschaft Holzwerkstoffe e.V.), Gießen, for monitoring quality and testing specifications of WPC products.