

1 An extensometer quantifies the strain of material specimen

2 CarboAir material specimen

MATERIALS DEVELOPMENT AND TESTING

Fraunhofer IWES

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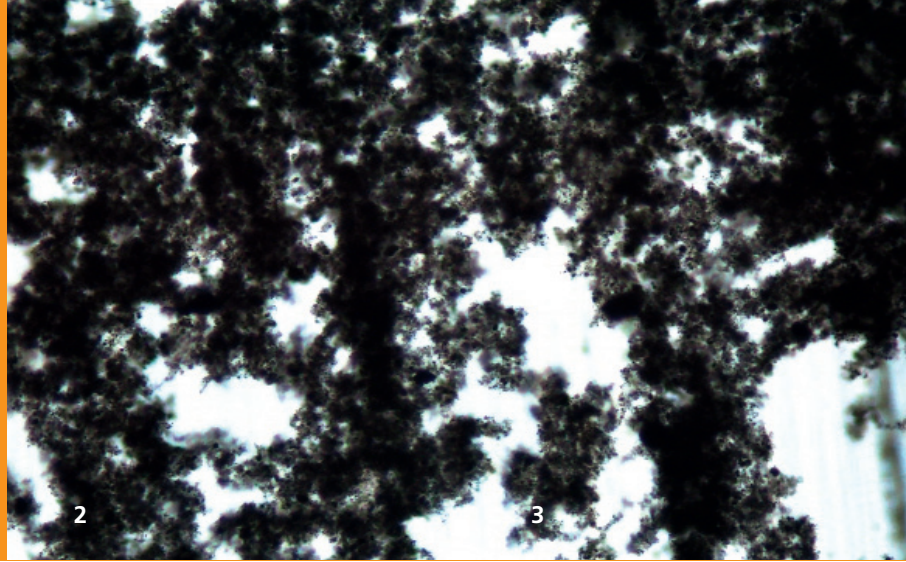
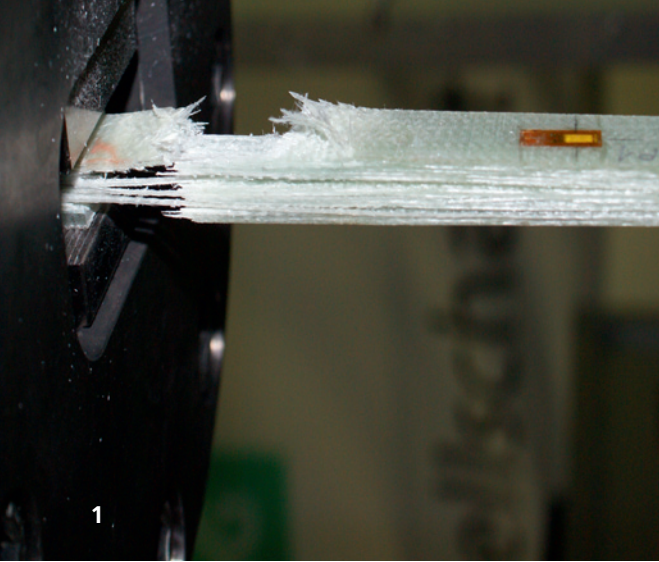
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Challenges

The materials that are used to manufacture rotor blades for wind turbines are subject to special, and in some cases unique, requirements. For example, the number of load cycles and the load variability are far beyond what is encountered by other structures in aviation, shipbuilding, and bridge building. For that reason, the optimization of the design and construction of rotor blades for the new generation of wind turbines presumes a wide range of mechanical, fracture-mechanical, physical, and chemical properties of the materials to be known.

Requirement

The unique loads to which materials are exposed in the wind energy sector put special requirements on those materials, for example favorable fatigue behavior, high resistance to wear, and production-related thermal and rheological properties. The determination of the specific properties of individual materials is vital. The materials are firstly subjected to various mechanical tests to determine, for example, the service life under a variety of load conditions, and also to environmental tests which provide important results on practical usage.



Areas of expertise

Fraunhofer IWES possesses many years of experience customizing the properties of materials, and testing the suitability of materials for rotor blades. For the determination of mechanical parameters specified in current standards and norms, coupon testing is an appropriate way for. These can be tailored to the individual wishes of customers by adapting the test equipment. Our experimental services cover the range of uniaxial tests for isotropic materials, cyclic-multiaxial tests for anisotropic materials, and the physical characterization of materials.

Individual tailoring of tests

For compression tests, a "combined loading" device that prevents buckling of the test specimen can be used. In most cases, these results are closer to reality than data required with standard methods. This device is also used for fatigue tests in order to determine meaningful Wöhler curves for compression-compression loading. For ageing studies, mechanical tests can be used in conjunction with a versatile climate chamber. The shear properties of adhesives and fiber composite materials can be determined on torsion test specimens. Besides testing standard coupon specimens, structures such as adhesive-laminate specimens can be tested. In addition, services ranging from material selection to material analysis are offered. These can include the development of material models, simulation of materials, and specific advanced development of materials.

Evaluation of combinations of materials

The development and evaluation of a wide range of combinations of materials, and in particular those of importance for lightweight construction, are another core competence of Fraunhofer IWES. This includes the manufacture of fiber composite materials. Besides the development of materials for structure-supporting elements, such as spar caps or shear webs, fillers and coating materials are also tested for their suitability for use on wind turbines.

Services

Applied materials development

- Determination of the suitability of materials for wind turbine rotor blades
- Fundamental experimental tests on material behavior
- Determination of the ageing behavior of materials under the influence of moisture, salt, UV light, and other offshore-specific environmental factors
- Application and advanced development of strength hypotheses

Materials testing

- Static tests
- Cyclic tests
- Tests on fiber composite materials
- Material analysis (including optical microscopy, density, thermal and rheological properties)
- Development of material models and simulation of materials

In addition to the standard range of services, customized testing can also be undertaken. Please contact us to learn more about the opportunities.

- 1 *New test methods stimulate product development*
- 2 *Micrograph of the fiber structure of a material enriched with carbon nanotubes*