

- 1 *Assembling a test specimen*
- 2 *Testing a DEBRA-25 rotor blade*

COMPONENT TESTING AND PRODUCTION

Fraunhofer IWES

Am Seedeich 45
27572 Bremerhaven / Germany

Contact persons

Dr. Arno van Wingerde
Phone: +49 471 902629-23
arno.van.wingerde@iwes.fraunhofer.de

Dipl.-Ing. Florian Sayer
Phone: +49 471 902629-22
florian.sayer@iwes.fraunhofer.de

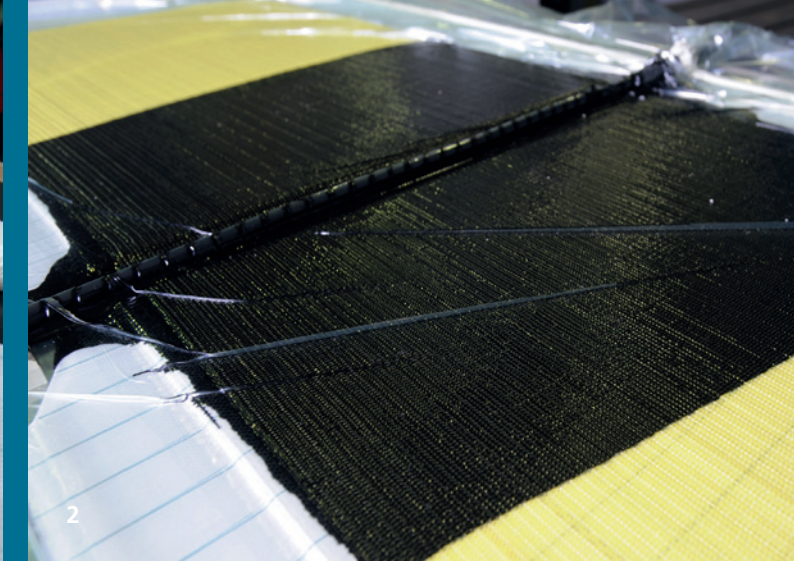
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Rotor blades of wind turbines are complex, large-area, highly stressed structures. They are usually made of fiber composite materials due to the requirement for lightweight design. In this regard, the anisotropic properties of materials are being increasingly utilized for the customized design of components and materials.

As fiber composite materials are produced during the production of components and their processing determines the material properties, knowledge of realistic material parameters is a key advantage. Component-specific specimen production and test methods are used. Fraunhofer IWES possesses in-depth expertise in specimen production and testing.

Production of fiber composite test specimens

The behavior of a material during production depends on the conditions to which the component is exposed. From a mechanical viewpoint, production-related tests on small components are necessary even prior to construction of the first prototypes. In addition, modifications to the as-received specimens and test set-ups are often unavoidable for mechanical tests. Fraunhofer IWES has profound knowledge of production and mechanical testing of fiber composite materials and adhesives. Besides expertise with standard methods, IWES scientists have extensive know-how in the production of new specimen geometries and preparation methods, for example for the testing of materials for rotor blades.



In addition, the production of small rotor blades for demonstration purposes or for small wind turbines is a service offered by Fraunhofer IWES.

Testing components

The development and construction of components and structures is accompanied by tests on materials. This is a vital part of the quality assurance process. Due to the size of rotor blades and the component-related behavior of materials, manufacturers are also increasingly carrying out tests on specimen beams and components. Fraunhofer IWES prepares the materials for this, develops test methods, and undertakes detailed evaluations.

Components are nowadays being increasingly tested for their structural durability, in order to avoid distortion of the calculated structural durability due to factors such as normal and shear stresses, force deflections, material combinations, and production methods. In particular, these

new test methods are highly advanced for bonded seams and ply drops, and can provide important information for rotor blade manufacturers. At Fraunhofer IWES there are three test platforms with a maximum size of 12 x 3 meters and relevant mounting structures for testing a variety of components and subcomponents. The test specimens can be stressed with powerful hydraulics (maximum 100 kN) or with an excenter (e.g. 20 kN at 2 Hz) - for example for determining Wöhler curves at a high number of load cycles. Smaller loads can also be applied for other purposes. The effect of environmental conditions can also be simulated using a climate chamber in which the temperature, humidity, UV light, and salt content can be regulated as wished.

Computer simulations can accompany the experimental testing. The simulation programs ANSYS and ABAQUS are available for this. These software solutions are also suitable for processing very complex, non-linear tasks.

Services

Production:

- Production of coupon specimens
- Preparation of specimens from components and structures
- Production of beam specimens
- Production of demonstration rotor blades

Component testing:

- Development of test concepts
- Design of subcomponents
- Static and dynamic testing of components
- Testing under extreme climatic conditions (including salt spray and UV light)

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

1 *Component production:
Shear web of a beam*

2 *Manufacture of a fiber composite sheet containing nanoparticles*