

Material selection for robust blades

For 18 years EUROS has been developing and producing rotor blades for wind turbines. The company has built the second longest rotor blade in the world having a length of 81.6 m aiming for durability. As during a service life of 20 to 25 years Cost of Energy (CoE) is significantly driven by the reliability of the rotor blades, EUROS optimises its custom-tailored blades regarding CoE.

Aerodynamic design drives the robustness of energy conversion under any environmental condition. Thereby aerodynamic and structural loading are driving the mass of a rotor blade and the turbine's components. The availability of the turbine directly influences its yield where structural integrity of the rotor blades and the whole turbine is highly appreciated.

Berlin-based EUROS with engineering and production sites in South Poland and on the Baltic coast supplies optimised rotor blades to reduce total CoE over a turbine's lifetime. The reduction of rotor blade structural mass while maintaining or improving durability and robustness regarding aerodynamics and structure is the central challenge. One approach is choosing the right material in the right position. To increase quality, EUROS relies on a mix of carbon and glass fibre, epoxy resins as matrices, PMI foam and balsa wood as core materials as well as toughened epoxy adhesives for structural bonding.

E-, E-CR-, R-glass or carbon fibre are chosen for the spar caps to provide stiffness to EUROS' rotor blades utilising the Direct Roving in-house Tow-Preg Processing (DRITP). This results in low structural mass, robustness regarding waves and

undulations, prolonged fatigue life and processing stability.

Important contributions to the damage properties of the final composite products are made by fibre sizing and resin matrix. The durability of the rotor blade can be improved by delaying the onset of damage in the load carrying structure due to fatigue loads. High performance epoxy resins are applied within the shells providing low viscosity, extended open time at fast TG build-up and short curing time.

The core materials for sandwich application need to provide little resin uptake at high mechanical performance and thermal stability. EUROS' sandwich panels with intermediate buckling loads feature a high performance PMI foam core. They are designed incorporating balsa wood which delivers excellent mechanical properties related to its density. They provide high buckling resistance at low structural mass and short production cycle time due to increased allowable curing temperatures. Shells and shear webs of the blades are joined during the production process utilising a toughened epoxy adhesive. The choice of the right leading edge protection coating makes the rotor blade resistant against particle and rain erosion or UV radiation.

EUROS cultivates a close cooperation with its suppliers regarding the development of the applied materials facing increasing requirements to their mechanical and processing performance, durability and cost. Thereby understanding and know-how are gained for the materials of the next rotor blade generation.

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