

TOWARDS COST-EFFECTIVE INDUSTRIAL DEPLOYMENT OF SELF-HEATING ADHESIVES FOR WIND TURBINES ROTOR BLADES

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Abstract

Wind turbine blades are made of composite material, consisting of various materials with different properties, which boost the performance of wind energy by allowing lighter and longer blades. One of the most important stages of the wind turbine manufacturing process is the structural elements bonding that guarantee the optimized transfer of the loads. This stage is one of the last before surface finishing (painting) of the blade and is a crucial production issue in terms of labor, equipment and tooling capacity. As the volume production increases, constraints may appear due to the total production tool usage time; this mainly depends on the resin mold filling, curing and adhesive bonding cycles. At this point, new adhesive material technology developments represent the encouraging business opportunity to tackle these cost dominant drivers.

Wind turbine blades structural adhesive requirements are critical for optimized performance and depend on each blade design and molding technology. Different processing and application of adhesive polymer systems in wind industry have to be considered due to multiple material design. A crucial issue in terms of production requirements is the curing time and thermo-rheological material behavior. In this work, the use of self-heating polymer systems is explored by using nano-thermites blended into advanced polymer bonding paste to significantly reduce the curing process, optimize application time, and therefore to have positive effect on the overall blade manufacturing cost reduction.

The research is focused on the new technology development in regards of two main objectives: first, the design and characterization of the adhesive chemical system with embedded tailored nano-particles, and the second objective is achievement of the process requirements for possible industrialization assessment. The investigation covers also potential avenues of the explored material technology comparing with other alternative commercial systems.

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