THERMOMECHANICAL CHARACTERIZATION AND PROCESSING OPTIMIZATION OF POLYMER ADHESIVES FOR STRUCTURAL COMPOSITE PARTS

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1 General Introduction

One of the most important stages of the composite manufacturing process in many industrial sectors as the wind industry or the automotive industry is the structural elements bonding that guarantee the optimized transfer of the loads [1]. This stage is one of the last before surface finishing (painting) of the part 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 development represents the encouraging business opportunity to tackle these cost dominant drivers.

2 Methodology

Structural adhesive requirements are critical for optimized performance and depend on each part design and molding technology. Different processing and application of adhesive polymer systems have to be considered due to multiple material design and specific needs. A crucial issue in terms of production requirements is the curing time and thermo-rheological material behavior. On the other hand, mechanical properties as hardness, tensile properties, shear strength, fatigue and, T-Peel resistance among other have to be optimized.

Material testing and requirements for industrial qualification are defined for comparison and validation with a commercial system. The test methods to be done refer to the actual qualification procedures and test methods to be used during serial production for qualification. International test standards have to be selected as basis for material characterization methods.

3 Results

In this work, different polymer systems analysis is explored in order to significantly reduce the curing process, optimize application time, and therefore to have positive effect on the overall part manufacturing cost reduction. The research is focused also with the objective of achievement given process requirements for possible industrialization assessment. Two generic case examples are developed for wind industry and automotive parts production.

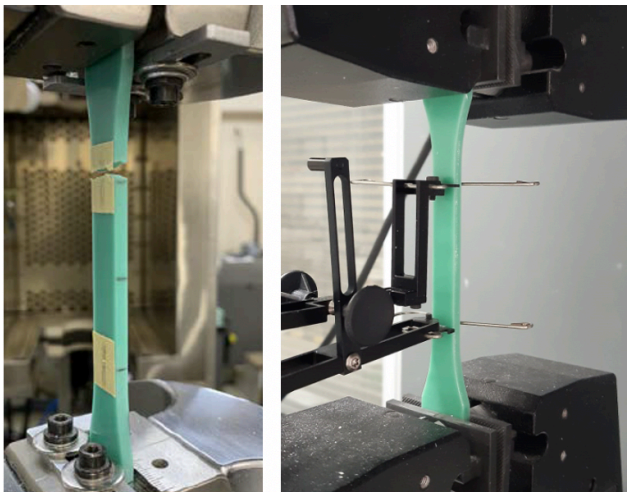

Fig.1. Tensile properties mechanical characterization.

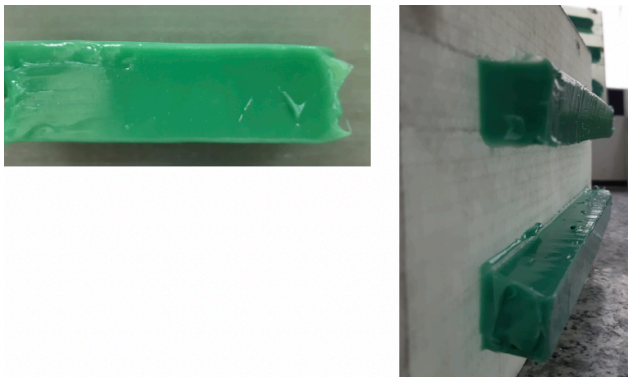

Fig.2. Sag resistance development.

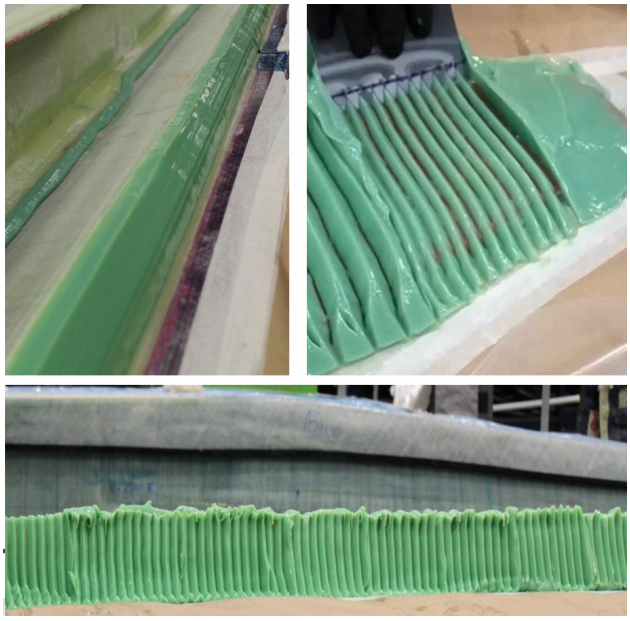

Fig.3. Bonding paste application procedure in wind turbine blade structures.

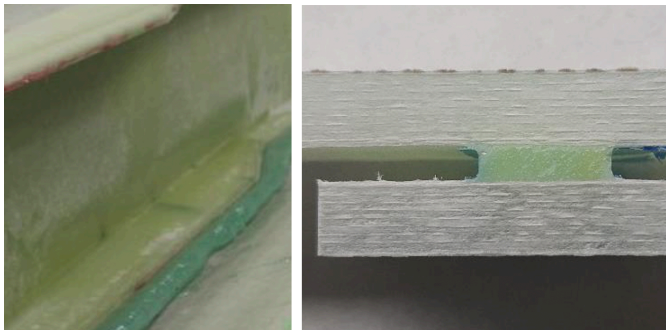

Fig.4. Adhesive joint of structural components

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