

Pressure Bag Molding: Manufacturing, Mechanical Testing, Non-Destructive Evaluation, and Analysis

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Abstract

Process limitations in Resin Transfer Molding (RTM) have been identified that make this otherwise popular process less attractive for the fabrication of wind turbine blades, especially as the size of new blades increases. Three main areas of research were addressed in this work. The first was “pressure bag molding,” a variation of RTM designed to remedy limitations inherent with RTM. Critical manufacturing process parameters were identified and testing conducted to compare these parameters for pressure bag molding to those of RTM. The second area of research was a new non-destructive evaluation method for fiberglass materials that involves the transmittance of infrared light through a laminate. Exploratory tests were conducted to gain an understanding of the behavior of this method of evaluation. A damage accumulation test was designed to compare damage accumulation properties of products of RTM to those of pressure bag molding. The third research focus was the development of a numerical progressive damage model. ANSYS was used to model the complex damage behavior of the layered, angled laminates that were chosen for the damage behavior comparison. Process parameter tests showed superior performance for pressure bag molding. Mechanical testing showed similar performance for pressure bag molding products, except for slightly reduced performance in the compressive strength test. The progressive damage model seemed to provide reasonable results. The resolution in the mechanical damage accumulation measurement was not adequate to facilitate reasonable comparison to the ANSYS model.