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Viscoelastic distortion in asymmetric plates during post curing

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Abstract

This study aims at understanding the geometrical instability triggered by the residual stresses generated during the manufacturing and post-curing of composites plates. Asymmetric plates with a [0/90] configuration were manufactured by Resin Transfer Molding (RTM). Manufactured plates were reheated free standing in an convection oven to study their behavior at high temperatures. Digital image analysis was used to monitor the plates curvature evolution with time and temperature. The experimental results of this work demonstrates the impact of the resin's viscoelastic behavior on the geometrical distortion generated by residual stresses in asymmetric plates at high temperatures.

Keywords: A. 3-Dimensional reinforcement B. Creep B. Residual/internal stress E. Resin transfer molding (RTM)

1. Introduction

Composite parts are subjected to thermo-chemo-mechanical phenomena during manufacturing that induce residual stresses. Residual stresses are self-balanced stresses that are present in the structure free of any external load or thermal gradient. Their presence can induce matrix cracking, delamination and/or part warpage (Ruiz and Trochu, 2005a; Bayraktar et al., 2012). The Coefficient of Thermal Expansion (CTE) mismatch between the fiber and the matrix, the matrix cure chemical shrinkage and the tool-part interaction are known to be the main causes of the residual stresses generation (Radford