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Abstract

Process-induced strains have an important role on the development of residual stresses and final dimensions of composite parts. It is of utmost importance to characterize them in order to optimize the process conditions. This paper is devoted to the presentation of a new device, which can measure the curing strains of thermosetting composite materials under process representative conditions (temperature and pressure up to 200°C and 1.0 MPa, respectively). The sample strains are recorded along two directions (through-thickness and in-plane), and the degree of cure is estimated in the same time. The device has been thoroughly validated thanks to several tests, demonstrating its accuracy. Two specific materials were tested, *i.e.* a glass-vinylester SMC and a UD carbon-epoxy composite. The measured coefficients of thermal expansion and of chemical shrinkage are in excellent agreement with both theoretical and experimental values available in the literature.

Keywords: A. Thermosetting resin, B. Thermomechanical B. Anysotropy, D. Process monitoring.

1. Introduction and literature survey

After several decades of research and technological developments on composite materials, the manufacturing of high quality composite parts with perfectly controlled final shape and internal state still seems to be an ideal and hard-to-reach goal. Due to their high specific mechanical properties, composite materials are well known candidates for mass and subsequent energy consumption reduction. Unfortunately, this technology is based on the use of fibres (continuous or discontinuous, woven or unidirectional) which implies a complex and strongly anisotropic microstructure, together with a polymeric matrix, which undergoes chemical or physical transformations during manufacturing. Among