In-Situ Characterization of Carbon Reinforced Epoxy Using Fibre-Optic Sensor and Transverse Electrical Resistance

R. KSOURI, K. SZYMANSKA, M. SALVIA, M. BENOUIS and R. MERDES

ABSTRACT

Thermosetting composites such as epoxy resin reinforced with carbon fibre offer excellent mechanical behaviour, good damage tolerance and attracted much attention in engineering and technological fields. However, most forms of CFRP subjected to steady long-term loading exhibit time-dependant behaviour (creep) even from ambient temperature due to time-dependent behaviour of polymer matrix. As carbon fibres exhibit negligible time-dependent behaviour, creep is very low in unidirectional composites loaded in the longitudinal direction but any angle-ply composites or unidirectional fibre composites subjected to transverse loading, exhibit time-dependant behaviour since it is dominated by the matrix viscoelastic properties. The most important factor which can control the properties of the matrix and of the fibre-matrix interface is in particular the cross-linking density resulting from the manufacturing process that is linked to the degree of cure.
This work deals with a procedure to in situ monitor the cure mechanisms of an epoxy resin reinforced with continuous carbon fibre using both a fibre-optic sensor embedded in the CFRP and transverse electrical resistance. The optical sensor provides refractive index measurements versus time in close relationship to the degree of advance measured in differential scanning calorimetry (DSC). The electrical measurements allow determining the gelation and vitrification cure transitions which occur during the reaction of polymerization. The agreement between refractive index and transverse electrical resistance data is good.

INTRODUCTION

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480

Код: 10614

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Издательство DEStech Publications, Lancaster, 2010 год

6 стр; формат: 23,5 x 16 см; библиографический список: 11 единиц
ISBN: 978-1-60595-024-2

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Ключевые слова:

Содержание.