

Accepted Manuscript

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PII: S1359-835X(15)00075-5

DOI: <http://dx.doi.org/10.1016/j.compositesa.2015.02.023>

Reference: JCOMA 3867

To appear in: *Composites: Part A*

Received Date: 22 October 2014

Revised Date: 3 February 2015

Accepted Date: 28 February 2015



Please cite this article as: Agius, S.L., Fox, B.L., Rapidly cured out-of-autoclave laminates: understanding and controlling the effect of voids on laminate fracture toughness, *Composites: Part A* (2015), doi: <http://dx.doi.org/10.1016/j.compositesa.2015.02.023>

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Rapidly cured out-of-autoclave laminates: understanding and controlling the effect of voids on laminate fracture toughness

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ABSTRACT

Voids are one of the most significant defects found within composites and have been demonstrated to reduce the performance of composite structures. The understanding of the impact of the size and distribution of voids on laminate properties is still limited because voids have proven difficult to deliberately control. This study aims to understand the mechanisms by which voids are generated within out-of-autoclave cured laminates. In this study, a process of prepreg conditioning was developed to control the level of voids within test laminates. Non-conditioned laminates highlighted signs of void growth (1.5%), while conditioned laminates showed consistently low levels of voids (<0.3%). Mass spectrometry indicated higher levels of aqueous and solvent volatiles within the non-conditioned prepreg. Finally, Mode II fracture testing revealed a 21% improvement in toughness for the non-voided laminates. A model on the effect of voids within the Mode II stress state has also been proposed.

Keywords: A. Prepreg; B. Porosity; B. Fracture toughness; D. Optical microscopy Physical methods of analysis

1 INTRODUCTION

Voids are considered one of the most critical defects found within composite structures, and as a result, industry such as aerospace undergo vigorous Non Destructive Evaluation (NDE) and set tight limits on overall content within their primary structures (typically < 1%). The reason is that voids result in reductions to composite strength, particularly for matrix dominated properties. Literature has highlighted

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