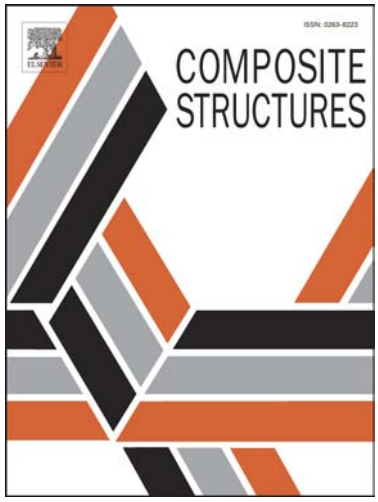

Development of a novel cyanoacrylate injection repair procedure for composites

P.G. Slattery, C.T. McCarthy, R.M. O'Higgins

PII: S0263-8223(16)30769-3
DOI: http://dx.doi.org/10.1016/j.compstruct.2016.05.101
Reference: COST 7514

To appear in: *Composite Structures*

Please cite this article as: Slattery, P.G., McCarthy, C.T., O'Higgins, R.M., Development of a novel cyanoacrylate injection repair procedure for composites, *Composite Structures* (2016), doi: http://dx.doi.org/10.1016/j.compstruct.2016.05.101

Development of a novel cyanoacrylate injection repair procedure for composites

P. G. Slattery[a], C. T. McCarthy[a], R. M. O'Higgins[a,*]

[a] *IComp: The Irish Centre for Composites Research, Materials and Surface Science Institute, Department of Mechanical, Aeronautical and Biomedical Engineering, University of Limerick, Limerick, Ireland*

Abstract

In this study, a novel resin injection repair procedure and rig have been developed that have several advantages over current repair methods including a relatively low curing temperature and the use of common laboratory equipment. Cyanoacrylates (CAs) have been chosen as the repair resin due to their very low viscosity. Impact damage was introduced to carbon fibre epoxy resin specimens using a drop tower instrument. An impact energy of 20 J resulted in repeatable damage consisting of delaminations, matrix cracks and breakout where the plies close to the impacted surface were not fractured. Compression after impact testing was performed to evaluate the success of the repair procedure. Damaged specimens retained 45.1% of the ultimate compressive strength of pristine specimens. It was found that up to 92.4% of the compressive strength of pristine specimens was achieved by specimens repaired with a liquid CA using the developed repair procedure. Repaired specimens had similar damage tolerance to pristine specimens and displayed only minor decreases in compressive strength after fatigue loading.

Keywords: Residual stress, Composite repair, Impact damage

1. Introduction

Polymer-matrix composites (PMCs) are increasingly used in several industries as a replacement for metallic structures due to their high specific strength and specific stiffness [1]. Impact damaged PMCs contain complex failure mechanisms including delaminations, matrix cracks, fibre breakages and penetration [2, 3]. Despite not always being visually detectable this damage can significantly reduce the strength of PMCs [4–8]. Repair of such damage is critical to ensure structural integrity of the laminate. While a number of repair strategies have been proposed, patch or scarf repair have found greatest application in

*Corresponding author at: Materials and Surface Science Institute, Department of Mechanical, Aeronautical and Biomedical Engineering, University of Limerick, Limerick, Ireland.
E-mail address: ronan.ohiggins@ul.ie (R.M. O'Higgins)