

Accepted Manuscript

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PII: S0263-8223(16)30030-7

DOI: <http://dx.doi.org/10.1016/j.compstruct.2016.02.010>

Reference: COST 7222

To appear in: *Composite Structures*



Please cite this article as: Czél, G., Jalalvand, M., Wisnom, M.R., Design and characterisation of advanced pseudo-ductile unidirectional thin-ply carbon/epoxy– glass/epoxy hybrid composites, *Composite Structures* (2016), doi: <http://dx.doi.org/10.1016/j.compstruct.2016.02.010>

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**Design and characterisation of advanced pseudo-ductile unidirectional thin-ply carbon/epoxy–
glass/epoxy hybrid composites**

Gergely Czél^{1,2}, Meisam Jalalvand², Michael R. Wisnom²

¹MTA–BME Research Group for Composite Science and Technology, Budapest University of Technology and Economics, Műegyetem rkp. 3., H-1111 Budapest, Hungary

²Advanced Composites Centre for Innovation and Science, University of Bristol, Queen's Building, BS8 1TR, Bristol, United Kingdom

* corresponding author, e-mail: czel@pt.bme.hu, Tel.: +3614631462,

Fax: +3614631527

Abstract

A comprehensive set of thin-ply pseudo-ductile unidirectional interlayer hybrid composite materials comprising S-glass and a variety of thin carbon prepregs was designed and characterised. Unique elastic-yielding-hardening type stress-strain responses similar to those of ductile metals were achieved through fragmentation and stable pull-out of the carbon layers, generating a range of initial moduli, pseudo-yield strains, plateau stresses and pseudo ductile strains for the various configurations. The typical failure modes of thin-ply hybrid composites were highlighted in four series of stress-strain graphs obtained for the same materials with different carbon layer thicknesses. The predicted failure modes agreed well with the experimental results and demonstrated the merit of our two step design framework based on (i) simple analytical criteria and (ii) novel damage mode maps.

Keywords:

Pseudo-ductility; Thin-ply composites; Fragmentation; Delamination; Damage and fracture mechanics; Mechanical testing;

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