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Author: Prof. Robert Walsh
University of Central Lancashire, United Kingdom

EVALUATING GRAPHENE-ENHANCED MATERIALS FOR SPACE-BASED STRUCTURAL APPLICATIONS

Abstract

The University of Central Lancashire has helped accelerate the application of graphene-enhanced materials (GEMs) in the aerospace industry since 2015. In conjunction with the UK National Graphene Institute (NGI), we produced graphene enhanced 3D printing filaments to manufacture sample aerospace parts, flew the first graphene-coated wing on a UAV, and in 2016 produced the world's first graphene enhanced carbon fibre wing. Subsequently, UCLan are leading the development of the UK Strategy document on behalf of the UK Aerospace Technology Institute into GEMs.

Here we present research funded by the UK Space Agency to demonstrate the potential of GEMs for structures residing in a (near-)space environment. In collaboration with Haydale and in conjunction with NGI, we outline results from a series of high altitude (up to 35km) balloon launches employed as a low-cost, low-risk stepping stone to examine the possible impact on GEM in this low pressure, low temperature environment.

Two different balloon payloads were investigated; (i) graphene-enhanced carbon fibre (GECF) and (ii) 3D printed graphene-enhanced poly lactic acid (PLA) with each compared directly to their non-graphene equivalents. Thermal and mechanical testing before and after flights will be outlined. Initial results show the garphene-enhanced cases to be an observable improvement on the non-graphene counterparts. Particularly in the GECF structure, a 20% mass reduction with observably improved mechanical properties will be the subject of further investigations. With the potential of significant weight reduction in the casings for similar payload volumes alongside increased structural robustness, GEMs may prove to be very attractive in producing improved and competitive space-based applications.