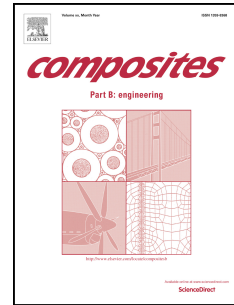


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Development of a closed-loop recycling process for short carbon fibre polypropylene composites

Rhys J. Tapper, Marco L. Longana, Hana Yu, Ian Hamerton, Kevin D. Potter



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1           **Development of a closed-loop recycling process for short carbon fibre**  
2                                   **polypropylene composites**

3                           Rhys J. Tapper\*<sup>1</sup>, Marco L. Longana<sup>1</sup>, Hana Yu<sup>†1</sup>, Ian Hamerton<sup>1</sup>, Kevin D. Potter<sup>1</sup>

4       <sup>1</sup> Bristol Composites Institute (ACCIS), University of Bristol, School of Civil, Aerospace and Mechanical Engineering,  
5                           University Walk, Bristol, BS8 1TR, United Kingdom

6                           \* To whom correspondence should be addressed: [R.tapper@bristol.ac.uk](mailto:R.tapper@bristol.ac.uk).

7                           <sup>†</sup>Department of Mechanical Engineering, University of Bath, North Road, Bath, BA2 7AY, United Kingdom

8   [www.bristol.ac.uk/composites](http://www.bristol.ac.uk/composites)

9   **Abstract**

10                    *In this study the effects of a closed-loop recycling methodology are evaluated for degradation using a*  
11                    *discontinuous carbon fibre polypropylene (CFPP) composite material. The process comprises two fundamental*  
12                    *steps, reclamation and remanufacture. The material properties are analysed over two recycling loops. For neat*  
13                    *polypropylene, the molecular weight analysis indicates evidence of minimal matrix degradation that does not affect*  
14                    *the material behaviour, as demonstrated by the shear tests. CFPP specimens show no decrease in mechanical*  
15                    *properties over repeated loops, the final specimens show an increase of 26 % and 43 % in ultimate tensile strength*  
16                    *and ultimate strain, respectively. These are attributed to cumulative matrix residue on the fibre surface after*  
17                    *reclamation and subsequently increased fibre-matrix adhesion. The improvement of CFPP properties and*  
18                    *insignificant variability in the tensile properties and molecular weight distribution of neat polypropylene validate the*  
19                    *potential of this proof-of-concept, closed-loop recyclable material. Future studies will investigate alternative, higher*  
20                    *performance matrices.*

21                    **Keywords:** Recycling; Polymer-matrix composites (PMCs); Compression moulding; Discontinuous  
22    reinforcement.

23       **1. Introduction**

24       The market share of carbon fibre reinforced polymer composites (CFRP) in the automotive industry is predicted to  
25       grow as the high-volume manufacture sector starts to adopt CFRP as a lightweighting strategy [1]. Vehicle fuel

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