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David Stoof, Kim Pickering



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# Sustainable Composite Fused Deposition Modelling Filament Using Recycled Pre-consumer Polypropylene Polypropylene

David Stoof and Kim Pickering\*

School of Engineering, University of Waikato, Hamilton, 3216, New Zealand,

[\\*klp@waikato.ac.nz](mailto:klp@waikato.ac.nz) (\*= corresponding author)

## Abstract

Composite filaments with differing harakeke, hemp fibre or recycled gypsum contents (0-50wt%) in pre-consumer recycled polypropylene (PP) were produced and mechanically assessed. Furthermore, a novel method of measuring shrinkage in 3D printed components was also developed and used to assess shrinkage of filaments. The most successful filaments contained 30 wt% harakeke fibre and had a tensile strength and Young's modulus of 39 MPa and 2.8 GPa respectively, providing improvements in tensile strength and Young's modulus compared to those of plain PP filament of 74% and 214% respectively. However, these properties were seen to reduce on printing, although fibre reinforcement was still observed to provide benefit in terms of strength and shrinkage. The cause of the mechanical property reduction was assumed to be stress relaxation of the polymer during printing which is conducted at lower pressure compared to filament production. 30 wt% harakeke filament also underwent the least shrinkage of 0.34% corresponding to a net reduction of 84% relative to plain PP.

**Key words:** A. Natural fibres, B. Mechanical properties, B. Shrinkage

## 1. Introduction

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