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Cork–PLA composite filaments for fused deposition modelling

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Abstract

We report design and development of cork–poly(lactic acid) (PLA) biodegradable filaments for fused deposition modelling (FDM), which is an additive manufacturing technique. Composites of varying cork composition were melt compounded in an internal mixer and compression moulded for characterisation of mechanical, thermal and morphological properties. Inclusion of cork granules decreased the tensile strength, but improved impact strength. As the cork percentage increased, density of the composites decreased. Hence, the specific modulus and specific tensile strength properties improved as the cork content increased in the composites. Tributyl citrate (TBC), a biodegradable plasticiser, was used to overcome the inherent brittleness of PLA. TBC decreased the modulus, tensile yield strength; however it increased ductility of the composites. A selected cork composite was used for filament production and it proved to be suitable for fused deposition modelling. 3D printed composites were compared with compression moulded composites. 3D printing resulted in slightly lower elastic modulus and tensile yield strength, but higher elongation at break compared with compression moulded composites.

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