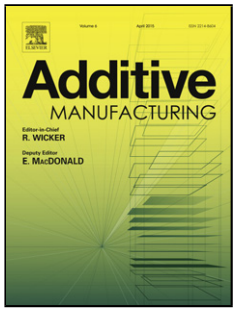

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PII: S2214-8604(16)30205-6
DOI: http://dx.doi.org/doi:10.1016/j.addma.2017.03.009
Reference: ADDMA 162

To appear in:

Received date: 25-8-2016
Accepted date: 23-3-2017

Please cite this article as: P.M.Toal, L.J.Holmes, R.X.Rodriguez, E.D.Wetzel, Microstructured Monofilament via Thermal Drawing of Additively Manufactured Preforms (2010), http://dx.doi.org/10.1016/j.addma.2017.03.009

Microstructured Monofilament via Thermal Drawing of Additively Manufactured Preforms

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Manuscript for submission to:

Additive Manufacturing

25 August 2016

Abstract

A process is presented for the rapid production of microstructured monofilaments via thermal drawing of additively manufactured polymer preforms. Preforms are produced wholly, or in part, via fused filament fabrication of acrylonitrile-butadiene-styrene (ABS) and polycarbonate materials. The preforms are heated and drawn under tension to convert the preforms into lengths of monofilament that closely reproduce the geometric structure of the parent preform. Example monofilaments include "microprinted" monofilaments that contain an arbitrary image embedded in the monofilament cross section; microfluidic monofilaments in which flow channels are formed by combining optically transparent and opaque materials; dual-material monofilaments that combine ABS and polycarbonate into a regular spoked geometry with five-fold symmetry; and a microfluidic preform co-drawn with glass optical fiber, allowing both fluid and light transmission through the monofilament. The primary advantages of this monofilament fabrication technique include short lead times; minimal investment in materials and equipment; a means of directly combining multiple materials into a single monofilament, even if the material components have different thermorheological properties; and the ability to create arbitrary and complex geometries.