Abstract

Shape Memory Polymer Microstructures Using Melt Electrowriting †

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Abstract: Melt electrowriting is a relatively new additive manufacturing technique capable of the controlled deposition of polymeric fibers to manufacture pre-programmed structures at micron scale. In this research, a blend of poly (ε-caprolactone) and thermoplastic urethane displaying shape memory properties is processed using melt electrowriting. The bulk material at macro scale shows a transition temperature of around 60 °C. Fibers with diameter less than 60 µm were deposited as sinusoids and grid-like scaffolds. A high strain fixity ratio of 92% was obtained for the polymer, which is in accordance with the literature on shape memory polymers. These shape memory structures can be used for applications such as micro-sensing and actuating.

Keywords: 4D printing; electrohydrodynamic; melt electrosprinning writing; stimuli responsive

1. Introduction

Melt electrowriting (MEW) is a fiber manufacturing technique that involves the fabrication of micron-sized polymeric fibers by extruding a polymer melt through a nozzle that is maintained at a high voltage relative to the collector (Figure 1a). The electric field across the nozzle-to-collector gap acts as the driving force to initiate and maintain the polymeric jet, which can be deposited in a controlled way. MEW is a relatively recent technology, and therefore there are few studies showing the printability and processability of functional or stimuli-responsive polymers [1,2]. Shape memory polymers (SMPs) are a class of stimuli-responsive polymers that have found application in various fields, such as biomedical devices, flexible electronics, sensors, and actuators [3]. These materials can be programmed into a temporary shape, which can be reverted to the original shape upon the application of an external stimulus. The fabrication of SMPs at micron scale has recently been gaining increased interest as it improves the versatility and potential for further applications in different areas [4].
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References


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