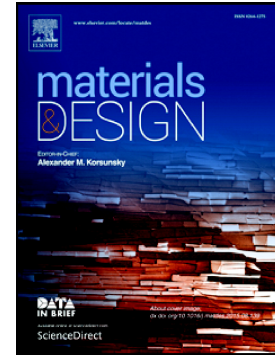


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Modeling 3D Melt Electrospinning Writing by Response Surface Methodology

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Abstract

Three-dimensional (3D) Melt Electrospinning Writing (MEW) is a promising technique for 3D printing of porous scaffolds with well-defined geometrical features. The diameter of electrospun fibers strongly affect the achievable resolution and consequently several other physical, mechanical, and structural properties of the fabricated scaffold. However, there are a few process parameters which significantly affect the size of electrospun fibers. In this study, response surface methodology (RSM) was used to investigate the critical and optimized process parameters and their interaction effects on the desired fiber diameter. Four process parameters, including collector speed, tip-to-collector distance, applied pressure, and voltage were studied considering their practical ranges. The results showed that all the parameters except the applied voltage had a significant effect on the printed fiber diameters. A generalized model for the interaction effects of the parameters was introduced which can be used as a framework for selecting the process parameters to achieve the desired fiber diameter. The developed model was validated by choosing random process parameters and printing three-dimensional scaffolds. The results confirm that the predicted fiber diameters match closely with the actual fiber diameters measured directly from the printed scaffold.

Keywords: 3D melt electrospinning writing, Response surface methodology, Three-dimensional scaffold printing, parameter optimization

1 Introduction

The demand for additive manufacturing processes is on the rise due to its unrivaled design freedom and ability to directly manufacture highly complex and customized geometries with various materials [1-5]. In recent years, additive manufacturing processes have been used to fabricate three-dimensional (3D) scaffolds for tissue

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