

Accepted Manuscript

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PII: S0167-577X(17)31914-6
DOI: <https://doi.org/10.1016/j.matlet.2017.12.146>
Reference: MLBLUE 23644

To appear in: *Materials Letters*

Received Date: 18 November 2017
Revised Date: 19 December 2017
Accepted Date: 29 December 2017

Please cite this article as: S. Jiang, D. Han, C. Huang, G. Duan, H. Hou, Temperature-induced Molecular Orientation and Mechanical Properties of Single Electrospun Polyimide Nanofiber, *Materials Letters* (2017), doi: <https://doi.org/10.1016/j.matlet.2017.12.146>

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Temperature-induced Molecular Orientation and Mechanical Properties of Single Electrospun Polyimide

Nanofiber

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Abstract

Mechanical properties of polyimide (PI) electrospun nanofibers could be improved by increasing imidization temperatures. However, the intrinsic mechanism on this phenomenon is highly required, which is helpful to improve mechanical properties of electrospun nanofibers by external thermal treatment. In this work, single electrospun PI nanofibers with different imidization temperatures were prepared. The nanofiber morphology was studied by SEM and AFM and the mechanical properties were measured by single fiber micro-tensile test.

Polarized Raman Spectroscopy was applied to determine the PI molecular orientation in single PI electrospun nanofiber (SNF-PI). The molecular orientation factor provides directly explanation on the effect of imidization temperatures on the mechanical properties of SNF-PI.

Keywords: Molecular orientation; Polyimide; Fiber technology; Electrospinning; Raman; Mechanical property

Introduction

Polyimide (PI) nanofibers produced by electrospinning possess excellent mechanical properties and thermal stability[1]. They have been applied as battery separators[2, 3], high flux and low fouling microfiltration[4], high temperature filtration[5], removal of PM2.5[6], reinforcements[7, 8], etc. One of the hot topic on electrospun PI

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