OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference on
Nanotek and Expo

December 3-5, 2012 DoubleTree by Hilton Philadelphia Center City, USA

Self-alignment of polymeric nanofibers by electrospinning

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Nano-fibers alignment is considered an important parameter in nanofibers production because different fiber conformations correlates with different results in tests such as cell growth, thermal and electrical conductivity, and mechanical strength. There are many methods for fabricating nanofibers; Electrospinning is perhaps the most straightforward. Although the fibers obtained by electrospinning are usually unaligned, several efforts are being made to obtain aligned fibers. Most part of these efforts focuses on moving parts to collect the electrospun fibers, such as rotating drums. One disadvantage of these methods is that is not possible to create hybrid mats consisting of aligned and nonwoven nanofiber regions. We report a novel method to achieve alignment of electrospun nanofibers without using any moving apparatus. We were able to create regions of nonwoven and aligned fibers in the same mat, controlling the size and geometry of each region. This method also allows obtaining different fiber density regions in the mat. The electrospinning was performed using a Gastight 1001 syringe and a 4"-long 20- gauge stainless steel needle from Hamilton Company. The applied voltage was about 10 kV, pumping rates from 5 to 30 μl/min and working distances from 3 to 10 cm. We used both polystyrene (PS) and poly-L-lactic-acid (PLLA) to produce 7.5% and 15% w/v solutions in 1/3 ratio of acetone/chloroform for electrospinning. The collector plate consisted in a CNC machined aluminum plate. Our result shows the construction of hybrid mats consisting of both aligned and nonwoven nanofibers using self-alignment of polymeric nanofibers by electrospinning.

Biography

Andre Sionek is an undergraduate student with major in physics at Universidade Federal does Parana in Brazil. He is participating of an undergraduate study abroad program at University of Pennsylvania under supervision of Jorge Juan Santiago-Aviles who conducts his research at the interface between electrical engineering and materials science, focusing on materials and devices for energy storage, nanoscale composites by electrospinning and electronic sensing/actuating.

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