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Low-Voltage Near-Field Electrospinning Enables Controlled Continuous Patterning of Nanofibers on 2D and 3D Substrates

Tech ID: 21459 / UC Case 2011-622-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,586,148	11/19/2013	2011-622

BRIEF DESCRIPTION

Researchers at the University of California, Irvine have developed a novel method to continuously pattern nanofibers on 2D and 3D substrates. A unique polymer ink formulation provides the right balance of viscosity and elasticity necessary to enable controlled, seamless near-field electrospinning of nanofibers at very low voltages.

FULL DESCRIPTION

The superelastic polymer ink formulation enables continuous electrospinning at a voltage of 200V, nearly an order of magnitude lower than conventional near-field electrospinning. At such low voltages, perturbations in the deposition pattern due to bending instabilities are reduced, thereby increasing control of the resulting polymer jet and resulting nanofiber. These qualities allowed for improved precision over the patterning capability of the nanofibers.

SUGGESTED USES

This fabrication ability will permit the use of electrospun nanofiber based wiring of structural and functional components in MEMS, microelectronics, optoelectronics, and sensor devices. Other applications may potentially include customized patterning of specialized polymeric nanofibers for production of advanced fabrics and improved bio-mimicry for scaffolds in tissue engineering.

ADVANTAGES

Current state-of-the-art fabrication methods for polymeric nanofibers fail to deliver precise, inexpensive, fast and continuous patterning capabilities. These deficiencies continue to hinder mass scale manufacturability and improvements in advanced applications of polymeric nanofibers.

This inexpensive, low voltage method allows for seamless electrospinning with superior control of nanofiber thickness and alignment, effectively reducing the patterning perturbations ordinarily dominant in higher voltage ranges of conventional near-field and far-field electrospinning.

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OTHER INFORMATION

KEYWORDS

near field electrospinning, NFES, low voltage, polymeric nanofiber, nanowires, interdigitated arrays, suspended carbon nanowires, suspended nanofibers, micro patterning, nano patterning, microfabrication, MEMS, tissue engineering, optoelectronics

In this setup, the voltage can be manipulated to directly control the thickness of the nanofibers. Operation at such low voltages effectively reduces the diameter of the jet, enabling unprecedentedly thin nanofibers.

Furthermore, this method enables smooth continuous transitions between nanofibers of different thickness via adjustment of stage velocity.

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