Technology market

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Method and device for polymer nano- and microfiber design and fabrication by dielectric barrier electrospinning

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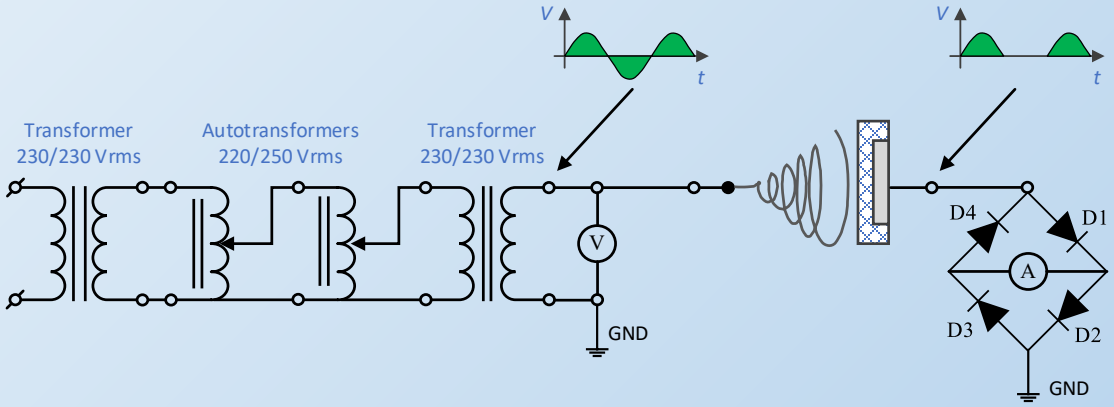
At the Technical University of Sofia, a method and device have been developed for the production of polymer fibers using electrospinning with a dielectric barrier and a variable electric voltage that periodically changes in ьзвсшкае and/or direction from a liquid. A patent application for this invention has been filed in Bulgaria.
Application № 113619



There are several known electrospinning methods, including those that use high direct or alternating voltage, gas or air-jet assistance, centrifugal force, multi-jet with high constant voltage, free surface with high constant and alternating voltage, sharp edges, and collectorless or active conductive collector methods. The goal is to create a method for the production of polymer fibers by electrospinning with a dielectric barrier, using an electrically conductive polymer-containing liquid solution, emulsion, or melt, with a highly variable electric field that changes periodically in magnitude and/or direction over time.

Technical solution

Researchers at the Technical University of Sofia have developed a method for producing polymer fibers (both nano- and micro-sized) by utilizing an electroconductive polymer-containing liquid solution, emulsion, or melt via electrospinning. This process involves applying a variable electric voltage that changes in amplitude and/or direction periodically, in air at normal atmospheric pressure and room temperature. An electric field is created between the high-voltage electrode of the electrofiber, which is in contact with the conductive liquid, and a grounded counter electrode positioned in the far region of the working air space. The electrofiber, which can be either single-jet or multi-jet, maintains a static or rotary working motion by directing one or multiple jets towards the counter electrode in the direction of the electric field. The counter electrode has a suitable spatial shape and structure and can remain stationary or move to create a non-ordered or ordered non-woven fibrous structure.

Application and advantages

The described method for producing polymer fibers and non-woven fiber structures based on them by electrospinning with a dielectric barrier and alternating electric voltage is characterized by enhanced manufacturability, versatility, reliability, and safety. This electrospinning technique can be applied in both laboratory and industrial settings, independently.

The method for producing polymer fibers and fibrous structures based on them by electrospinning with a dielectric barrier and alternating electric voltage allows for (1) safe electrospinning without the risk of entering the corona electric discharge mode, which could result in fire or explosion; the ability to fiberize polymer solutions with increased electrical conductivity and melts of electrically conductive polymers; (2) electrospinning with plasma-chemical surface modification of the produced fibers, safely switching to electrospinning mode with dielectric barrier discharge. (3) The dielectric barrier must sustain its insulating level, even when the air gap experiences complete electrical breakdown. (4) It must function at considerably lower voltage levels.

Technological images

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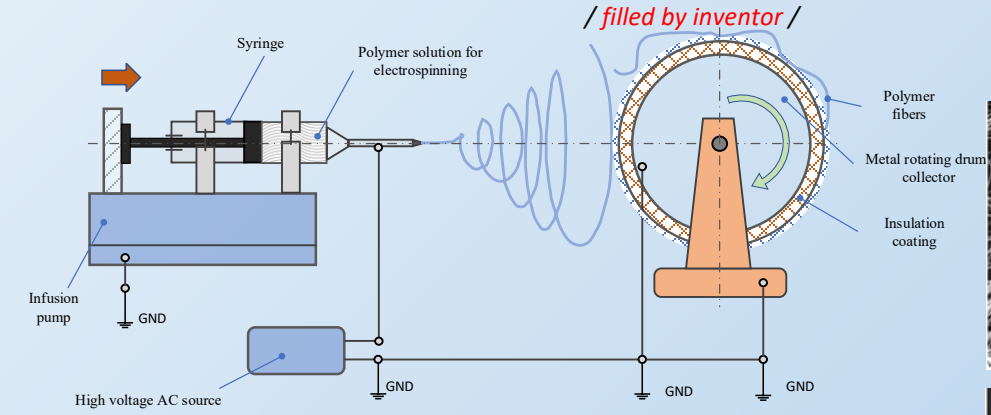

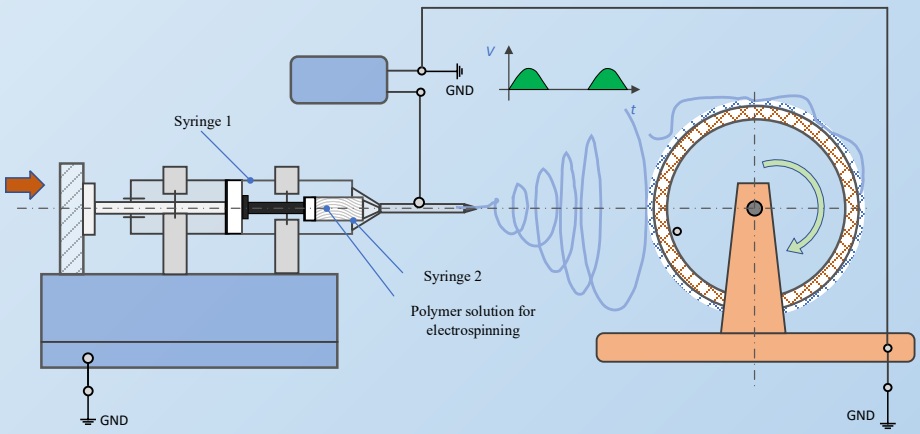

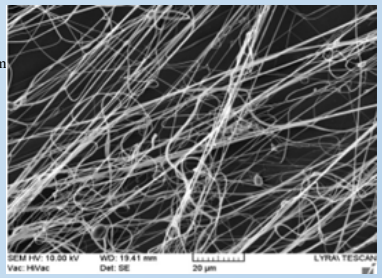

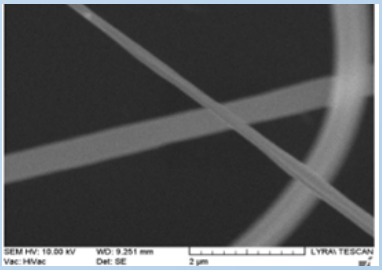

Morphology of an electrofibrous structure obtained by SEM in the presence of a dielectric barrier and a single-half-cycle rectified voltage of industrial frequency and 5 wt. % collagen solution

Contact for this offer

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