Science and engineering of electrospun nanofibers for advances in clean energy, water filtration, and regenerative medicine

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ABSTRACT

Nanostructured materials with high aspect ratio and one-dimensional (ID) morphology are nature's choices when high degree of functional performances and flexible properties are concerned. Two examples are extracellular matrices in tissues of living organism, and light harvesting rods of the retina and chlorophyll. Electrospinning (E-spinning) is a simple processing technique that allows fabrication of high aspect ratio nanofibers (NFs) in a commercial scale. Electrospun nanofibers (E-spun NFs) combine a number of physical properties such as guided electron transport, strain-induced electronic properties, high mechanical strength, high degree of flexibility, large specific surface area, high electron and thermal diffusivity, and tailorable pore distribution. Our laboratory has been involved in fabrication of E-spun polymeric, inorganic, and polymer-nanocomposite fibers in random, aligned, crossaligned, sheaths, tubes, yarns, core/shell, and trilayer morphologies. This article focuses on application of the E-spun fibers in the areas of clean energy, water treatment, and regenerative medicine in the authors' laboratory. In addition, the article briefly reviews the progress made in these areas using E-spun NFs.

Keywords: Clean energy; Electrospun nanofibers; Regenerative medicine; Nanofibers; water filtration

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