FM4L_10932

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Electrospinning of Nanofibers from Polymer Solutions

A.L. Yarin[(1)], E. Zussman[(2)]

(1) *Department of Mechanical Engineering, Technion – Israel Institute of Technology, Haifa, Israel*
(2) *Technion – Israel Institute of Technology, Haifa, Israel*

A straightforward, cheap and unique method to produce novel fibers with diameter in the range of 100 nm and even less, is related to electrospinning. For this goal polymer solutions, liquid crystals, suspensions of solid particles and emulsions are electrospun by a field of about 1 kVW/cm. The electric force results in an electrically charged jet of polymer solution outflowing from a droplet tip. After the jet flows away from the droplet in a nearly straight line, it bends into a complex path and other changes in shape occur, during which electrical forces stretch and thin it by very large ratios. After the solvent evaporates, solidified nanofibers are left. Nanofibers of ordinary, conducting and photosensitive polymers were electrospun. The present work deals with the mechanism and electrohydrodynamic modeling, experimental realization and a number of applications. In particular, we developed a unique electrostatic field-assisted assembly technique with the aim to position and align individual conducting and light-emitting nanofibers in arrays, crossbars and ropes. These structures are of potential interest in development of novel polymer-based light-emitting diodes, diodes, transistors, photonic crystals and flexible photocells. We also discuss our experiments on electrospinning of nanofibers reinforced by carbon nanotubes, and on coelectrospinning, which yields core-shell nanofibers and nanotubes.

View the extended summary