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Axial and radial nanostructures in electrospun polymer fibers[1]
ISRAEL GREENFELD, Technion, Israel, ANDREA CAMPOSEO, Università del Salento, Italy, FRANCESCO TANTUSSI, Università di Pisa, Italy , STEFANO PAGLIARA, Università del Salento, Italy, FRANCESCO FUSO, MARIA ALLEGRINI, Università di Pisa, Italy, DARIO PISIGNANO, Università del Salento, Italy, EYAL ZUSSMAN, Technion, Israel — The high tensional stresses during electrospinning of semidilute polymer solutions affect the dynamic conformation of the polymer network within the liquid jet, leaving a distinctive trace in the molecular structure after solidification. We investigated such effects in electrospun nanofibers made of conjugated polymers. Modeling the polymer network evolution during electrospinning showed that as the network stretches axially, it contracts towards the jet core. The model represents the semi-flexible conjugated polymer chains as flexible freely-jointed chains, whose joints are bonding defects. Using the conjugated polymer MEH-PPV dissolved in a mixture of THF and DMF solvents, and taking advantage of its unique photophysical characteristics, we investigated optically the variations in the density and orientation of the polymer macromolecules in electrospun nanofibers. In agreement with our model, we found higher density and axial orientation at the fiber core, while lower density and radial orientation closer to the fiber surface. The non-uniformity of the resulting molecular structure can be tuned and exploited in diverse optical and structural applications.

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