Electrospinning of carbon-nanotubes-PCBM-conjugated polymer fibers for photovoltaic applications

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Semiconducting π-conjugated organic polymers are used in photovoltaic (PV) applications as electron donors together with nano-structures such as fullerene derivates which act as electron acceptors. Upon illumination of the hybrid mixture, absorption of light results in the formation of a bound electron-hole pair, exciton. Charge separation then takes place at the fullerene-polymer interface.

Due to the short exciton diffusion length in these materials, mixing of the donor and acceptor on a nanometer scale is desirable, as it improves the efficiency of charge separation. Recently a 3 component system comprising of carbon nanotubes (CNT) - fullerenes-conjugated polymers was suggested as the photo-active layer. This class of devices aims to improve electron transport by utilizing single walled carbon nanotubes (SWNT) as the electron conductors.

In the current study we demonstrate the preparation via electrospinning of sub-micrometric fibers. The use of tailor-made tri-block copolymer to mediate the interactions between the components enables the electrospinning of long, uniform fibers of the polymer-nanostructures composites. The fibers exhibit improved crystallinity and efficient quenching of the photoluminescence, fulfilling the prerequisites for efficient light conversion.