

ELECTROSPUN MULTIFUNCTIONAL NANOFIBROUS MATERIALS

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Abstract: Electrospinning is a versatile and widely employed technique for the fabrication of nanofibrous polymeric or semiconductor materials with controlled morphology, high surface-to-volume ratio, and tunable functional properties [1]. ZnO nanofibers fabricated by this method are widely investigated due to the material properties such as electrical, optical, or antibacterial activity, making it suitable for multifunctional applications. Besides ZnO, tin sulfide-based materials, including SnS and SnS₂, have demonstrated promising performance in optoelectronic devices such as photodetectors [2] as well as in photocatalytic processes, particularly in the case of SnS₂ due to its favorable electronic structure [3].

In this study, we report on the fabrication of pure polymer and composite polymer–nanoparticle nanofibers via electrospinning process using a home-made system, and their characterization. The primary objective was to develop uniform nanofibrous mats based on poly(vinyl alcohol) (PVA), ZnO, as well as composite systems incorporating tin sulfide (SnS, SnS₂) nanoparticles, and to investigate the influence of processing parameters and material composition on fiber morphology and functional behavior. To combine antibacterial and photocatalytic functionalities within a single platform, SnS/SnS₂ nanoparticles were added into the PVA/ZnO precursor solution, which was subsequently processed via electrospinning to obtain composite nanofibers or ZnO/SnS (ZnO/SnS₂) heterostructures. The nanofibers were obtained at different voltages ranging from 15 to 25 kV and distances from 8 to 12 cm, followed by an annealing process in order to remove the organic compound. The resulting materials were analyzed in terms of morphology (SEM), composition (EDX), and potential multifunctional performance for application in sensing, filtration, optoelectronics and biomedical engineering.

Keywords: Electrospinning; nanofibers; composite materials; ZnO; chalcogenides

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