

Solution blow spinning of piezoelectric nanofiber mat for detecting mechanical and acoustic signals

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Abstract: Solution blow spinning (SBS) technique can produce nanofibers (NFs) mat in large-scale production. In this work, the SBS was used to fabricate piezoelectric polyvinylidene fluoride (PVDF) NF membranes that can be utilized for energy harvesting applications. The effect of operating air pressure from (2–5 bar) on the surface morphology of the NFs has been studied. The structural analysis for crystalline polymorph β -phase for PVDF powder, casted film, electrospinning and SBS NFs has also been presented with the aid of Fourier-transform infrared spectroscopy and X-ray diffraction (XRD). Piezoelectric characteristics of PVDF NFs mats were tested by applying impact impulse with different weights from different heights between 1 and 10 cm. The sensitivity of the voltage response increased from 1.71 mV/g to 8.98 mV/g, respectively. Besides, the SBS generated PVDF mat is found to be sensitive to pressure forces in a range of few Newtons with the generated voltage according to detected sensitivity of 80 mV/N based on the analysis of the impact of a few Hertz mechanical vibrations. In addition, the produced SBS NFs were applied as an acoustic signal detector within different acoustic frequencies. The results suggest that the β -phase PVDF nanofibrous membrane produced via the SBS technique has a great potential to be used as a piezoelectric sensor.