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Electrical Properties and Self-poling Mechanism of CNT/PVDF Piezoelectric Composite Films Prepared by Spray Coating Method

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Carbon nanotubes (CNT) / polyvinylidene fluoride (PVDF) piezoelectric composite films for nanogenerator devices were fabricated by spray coating method. When the CNT/PVDF mixture solution passes through the spray nozzle with small diameter by the compressed nitrogen gas, electric charges are generated in the liquid by a triboelectric effect. Then randomly distributed β phase PVDF film could be re-oriented by the electric field resulting from the accumulated electrical charges, and might be resulted in extremely one-directionally aligned β phase PVDF film without additional electric field for poling. X-ray diffraction patterns were used to investigate crystal structure of the CNT/PVDF composite films. It was confirmed that they revealed extremely large portion of the β phase PVDF crystalline in the film. Therefore we could obtain the poled CNT/PVDF piezoelectric composite films by the spray coating method without additional poling process. Charge accumulation and resulting electric field generation mechanism by spray coating method were shown in Fig. 1. The capacitance of the CNT/PVDF films increased by adding CNTs into the PVDF matrix, and finally saturated. However, the I-V curves didn't show any saturation effect in the CNT concentration range of 0~4 wt%. Therefore we can control the performance of the devices fabricated from the CNT/PVDF composite film by adjusting the current level resulted from the CNT concentration with the uniform capacitance value.

Keywords: carbon nanotube (CNT), poly-vinylidene fluoride (PVDF), piezoelectricity, composite film, spray coating, self-poling

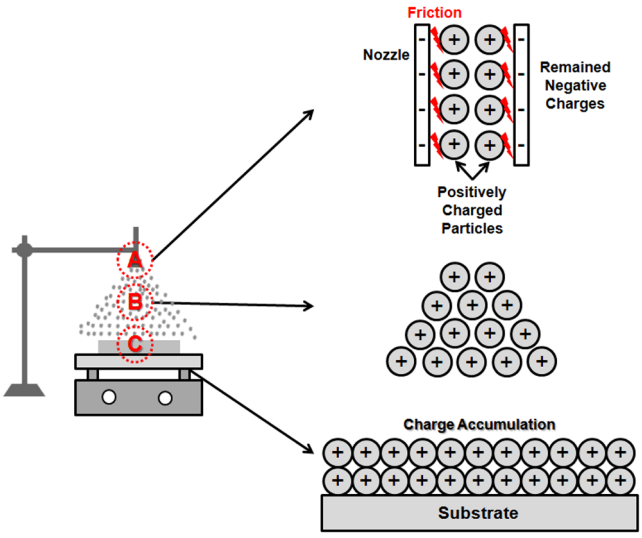

Fig. 1.