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**Pyroelectricity of electrospun polyvinylidene fluoride/tungsten oxide nanofibrous membranes**

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The electronics market had a strong driving force and tendency for developing portable and wearable electronic devices. This has stimulated the research interests in flexible, renewable and sustainable energy sources. Poly(vinylidene difluoride) (PVDF) is a pyroelectric and piezoelectric polymer and widely investigated for flexible electronics because of its high flexibility, biocompatibility and simplicity of production. A pyroelectric material such as PVDF can effectively convert thermal energy into a temporary voltage when they are heated or cooled. If the temperature stays constant at its new value, the pyroelectric voltage gradually disappears due to leakage current. Thus, a new heating technique such as light irradiation is important to replace the traditional conductive heating method and leads to the poor thermal conductive PVDF polymer with repeatedly fast heating and cooling behavior. A highly effective photo-thermal conversion material reduced tungsten oxide ( $\text{WO}_{2.72}$ ), having the temperature change of 60 °C within 30 seconds under infrared light radiation (IR) was developed in our research group. Therefore, it is highly interesting to study the pyroelectric response of the electrospun PVDF nanofibrous membranes incorporated with efficient photo-thermal conversion material ( $\text{WO}_{2.72}$ ) under IR radiation. In this study, a novel flexible pyroelectric power generator was developed by electrospun PVDF nanofibrous membranes incorporated with various weight fractions of  $\text{WO}_{2.72}$  powders. The effects of  $\text{WO}_{2.72}$  and electro-spinning (ES) parameters on the crystal structure and pyroelectric properties of PVDF/ $\text{WO}_{2.72}$  nanofibrous membranes were examined. Results show that ES effectively induced the  $\beta$ -phase of PVDF and the fraction of  $\beta$ -phase was further increased from 79% to 84% after adding with 7 wt%  $\text{WO}_{2.72}$ . Besides, the temperature of electrospun PVDF/ $\text{WO}_{2.72}$  nanofibrous membrane increased rapidly and reached 98.7 °C from room temperature while pure PVDF nanofibrous membranes only reach to 60.5 °C after 300 seconds under IR radiation. It demonstrated that  $\text{WO}_{2.72}$  presents excellent photo-thermal conversion characteristics due to the presence of free electrons or oxygen-deficiency-induced small polarons. As for the pyroelectricity measurement, the PVDF/ $\text{WO}_{2.72}$  nanofibrous membranes were sandwiched between two electrodes and the output voltage was measured by repeated heating and cooling process. Controlling by IR radiation, the temperature of the as received PVDF pyroelectric unit with  $\text{WO}_{2.72}$  was increased from room temperature to 51.6 °C during heating process and then rapidly cooled down to 29.9 °C within 3 minutes. When the temperature change is 21.7 °C, the maximum output voltage of the pyroelectric unit with  $\text{WO}_{2.72}$  reached to 80 mV which is largely enhancement compare to 30 mV of the unit without  $\text{WO}_{2.72}$  with 10.1 °C temperature change. Hence, the PVDF/ $\text{WO}_{2.72}$  with higher temperature change induces stronger pyroelectric response than pure PVDF sample. In addition, the PVDF/ $\text{WO}_{2.72}$  also shows good stability and durability of pyroelectric power output.

**Biography**

Min-Hui Chou is currently pursuing her Doctorate degree in the Department of Materials Science and Engineering from National Taiwan University of Science and Technology. Her current research interests are in the piezoelectric materials, electrospinning technology and its applications. She has published 2 papers in reputed journals and applied 2 invention patents.

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