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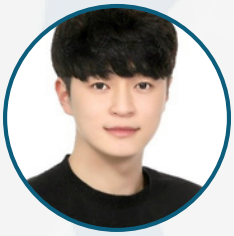

Woojin Lim a, Jungwoo Huh a, Jiwon Jang a

aSchool of Mechanical Engineering, Korea University, Seoul 02841, Republic of Korea

Flexible high-power piezoelectric nanogenerator fabrication: Augmenting electroactive β- and γ- phases of PVDF with supersonically sprayed Sr2SnO4 nanorods

Abstract: The presence of electroactive β- and γ-phases in poly(vinylidene fluoride) (PVDF) increased by more than two folds upon supersonically spraying Sr2SnO4 nanorods (SSO-NRs). Shear stress between the PVDF and SSO-NRs, induced by supersonic blowing and catastrophic impact against the substrate, amplified the β- and γ-phases, which enhanced the energy-harvesting performance of a flexible piezoelectric nanogenerator (PENG). The high-aspect-ratio SSO-NRs magnified the influence of shear stress by intensifying the turbulence induced by their swirling. The supersonically driven shear stress caused multidirectional stretching, elongation, and twisting of the PVDF and transformed a large amount of the α-phase into electroactive β- and γ-phases, as evidenced by X-ray diffractometry and infrared spectroscopy. The composite film with a minimal filler content of 2.5 wt% exhibited a piezopotential of 40 V without additional poling. The optimal SSO/PVDF-based PENG delivered a high power density of 87 μW·cm−2, when it was subjected to a tapping force. Furthermore, the practical applicability of the PENG was illustrated using air pressure, vibration, and human body movements. The fabricated PENG device was integrated with a supercapacitor electrode to demonstrate its wide range of applications in wearable and portable electronics.

Keywords: Strontium stannate, nanorod, piezoelectric nanogenerator

Biography: Woojin Lim is a Ph.D. candidate in the School of Mechanical Engineering at Korea University, Seoul, South Korea, since 2022. He received his B.S. degree from Dongguk University in 2022. His research primarily focuses on the fabrication of multifunctional films for energy harvesting and energy storage applications using supersonic cold-spraying techniques.

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