

A liquid metal-based triboelectric nanogenerator as stretchable electronics for safeguarding and self-powered mechanosensing

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Abstract

The widespread impact kinetic energy always causes injury and property loss in daily life and few works have been reported to gather and exploit the kinetic energy[1-3]. Triboelectric nanogenerator (TENG) proves to be a favorable device in harvesting mechanical energy but shows no protection property[4, 5]. It is urgent and meaningful to develop novel multifunctional TENG with self-powered mechanosensing and protection properties. In this report, a multifunctional TENG with energy-harvesting, safeguarding and self-powered force-sensing properties was fabricated by assembling shear stiffening gel/polydimethylsiloxane with GaInSn liquid metal. Operating at 10 Hz, TENG with $50 \times 50 \times 4 \text{ mm}^3$ obtains an output voltage of 35.72 V and maximum power of $182.17 \mu\text{W}$. In addition, the TENG device can generate enhanced output power of $323.97 \mu\text{W}$ under strain of 80%. Besides harvesting energy, TENG with fast stimuli-responsive character has been proven as a self-powered sensor to monitor varieties of physiological movements. More importantly, the TENG device enables to dissipate 66.43% of impact energy which provides protection effect. Correspondingly, the distinguished output voltage signals can also reveal and assess different impulsive loads. Thus, this functional TENG shows promising applications in energy-harvesting, safeguarding and self-powered mechanosensing areas.

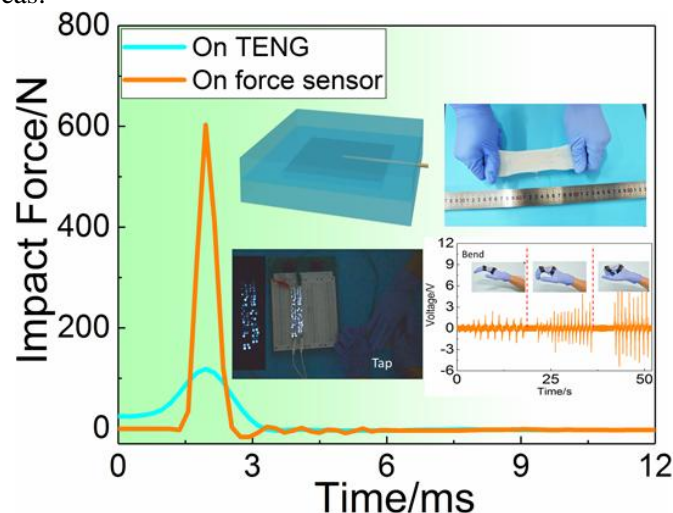


Figure 1: A stretchable triboelectric nanogenerator was prepared by assembling shear stiffening polymer/polydimethylsiloxane with GaInSn. It shows outstanding energy-harvesting properties under large tensile elongation. As a self-powered sensor, it enables to monitor physiological motions. Besides, the TENG device can impede external collision by decreasing most impact energy which works as a protection material for human beings.

References

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