A New Triboelectric Nanogenerator with Excellent Electric Breakdown Self-Healing Performance

Zhipeng wu[1], Yijun Shi[1]*

[1]Division of Machine Elements, Luleå University of Technology, Luleå, 97187, Sweden.

Triboelectric nanogenerator (TENG) can convert all kinds of mechanical energy into electricity. Comparing with the traditional electromagnetic generator (EMG), TENG has obvious higher efficiency in harvesting low frequency mechanical energy with advantages of much lower cost, smaller size and so on. However, TENG suffers unpredictable damages due to stretching, bending, compression, interface friction, electric breakdown, etc. Materials with self-healing properties provide a good solution to this problem. In this study, a new TENG was developed based on a new type polyurethane-based self-healing elastomer with good mechanical self-healing property (healing efficiency is about 96%) and excellent electric breakdown self-healing performance (healing efficiency is 90%). Self-healing mechanism study indicates that the excellent self-healing properties comes from a combination of intermolecular hydrogen bonding, weak and dynamic coordination bonds between Fe^{3+} and pyridine rings. The developed TENG can generate an open-circuit voltage of 180 V, a short-circuit of 1.3 μA, and with a maximum power of 40 $mW \cdot m^{-2}$. The developed TENG shows an excellent stability (no output performance degrading even after a 3000 cycles). It is also interesting to find that the output electrical properties of the developed TENG before and even after several times mechanical self-healing or electrical breakdown self-healing can be almost 100% restored to the original state. Don't modify the format of this document.

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*Corresponding author: yijun.shi@ltu.se