Polymer Composite Fiber-Based Triboelectric Material for Fabricating Improved Triboelectric-Nanogenerator and Method for Producing the Same

1. Technology:

The invention is in the field of energy harvesting technology, and applications of power production from a composite fiber material. Nowadays, flexible triboelectric sensors are the most promising candidates for wearable energy harvesting and health monitoring applications. The invention relates to the field of self-powered devices, particularly a triboelectric nanogenerator which is environment-friendly, easily available, flexible, and cost-effective. In this study, we fabricated a TENG device using metal oxides doped Polyvinylidene fluoride (PVDF) electrospun fiber as tribonegative material and polyurethane (PU) film as tribopositive layer. Preferably, d-block metal oxides such as copper oxide (CuO), nickel oxide (NiO), and nickel-doped copper oxide nanoparticles in three different ratios (50:50, 25:75, 75:25) were selected as doping materials. The co-precipitation method was used to prepare nanoparticles. Electrical measurements were carried out to confirm the practicability of the device's function as a wearable device and health monitoring sensor such as respiratory and heartbeat monitor.

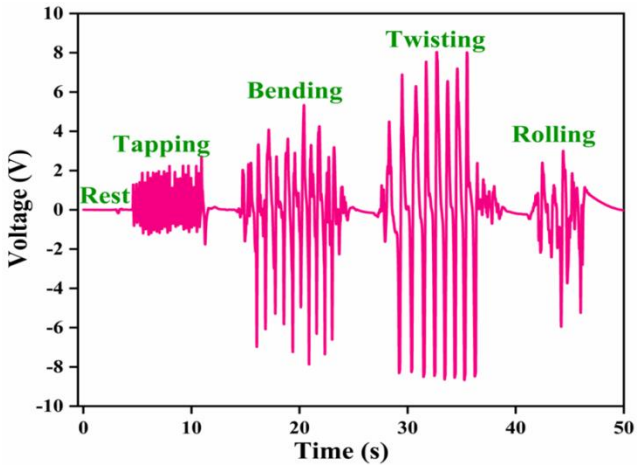

Fig. 1 TENG device output while tapping (3.7 V), bending (13.1 V), twisting (16.7 V) and rolling (8.8 V).

2. Problem Addressed:

Triboelectric materials can effectively harvest mechanical energy from human body movements. But device flexibility and durability are the main issue faced by them. For a sensor device to be commercially viable, it is essential to fabricate a device with higher sensitivity and lower power consumption. The invention is in the field of energy harvesting technology, particularly a triboelectric nanogenerator which is environment-friendly, easily available, flexible, and cost-effective. This invention focuses on exploring metal oxide nanoparticles doped PVDF-based TENGs for higher electrical output and applications.

3. Industrial Applications:

The fabricated TENG devices are environment-friendly, flexible, and cost-effective. Previously, Lead-based devices were reported for fabricating nanogenerators. But they are highly toxic materials and will affect the environment very harmfully. So, here we used lead-free materials for fabricating nanogenerators.

4. Patent Application Number: 202341084020