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Material synthesis and optimization for high performance Triboelectric nano generators

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Energy harvesting technology is an emerging technology, particularly important for the wireless sensor networks because it is that the core technology for internet of things (IoT), smart manufacturing and smart cities, etc. Since, wireless sensors are typically installed on mobile objects, in remote areas or harsh environments, it's extremely challenging to take care of their long-term sensing/monitoring function thanks to the requests for constant electric power or periodical replacement of batteries. Energy harvesting technologies are explored to power wireless sensors by utilizing piezoelectric, pyroelectric, electromagnetic and triboelectric effects. Triboelectric nanogenerator (TENG) is considered the foremost suitable one due to its very high power outputs and conversion efficiency. Great efforts specialise in the performance enhancement through the innovations to extend surface charge density. checking out better materials and optimal combination and modifying materials properties are the 2 common methods for obtaining triboelectric materials with high surface charge densities. we've been performing on these for a short time and achieved composite materials with excellent triboelectric properties and various optimal material combinations for TENGs. The talk will highlight our work on the simplest tribo-positive materials, synthesis of tribo-negative composites using polyvinylidene difluoride (PVDF) or polytetrafluoroethylene (PTFE) incorporated with piezo/ferroelectric nanomaterials like ZnO and Barium titanate (BTO) etc, and specific design for the electrode and tribomaterial interfaces. Using the simplest material combination and optimized device structures, we've fabricated flat-surface TENGs with peak voltage output over 1200 V and instantaneous power density within the range of 40-120 W/m2 with excellent stable function. Author also will present our latest unique technologies of the TENG-based chipless wireless sensors with self-identification capability and TENG as a wireless power source.

As an emerging branch of energy conversion technologies, triboelectric nanogenerator (TENG) invented in 2012 exposes a fresh path for effectively harnessing sorts of mechanical energies, which are ubiquitous and abundant but usually wasted in our ambient environment. So far, the TENG has experienced a rapid and booming development period, starting from architecture design, materials selection, and modification to performance optimization, power management, and application exploration.[14-25] By coupling two common phenomena of contact-electrification effect and electrostatic induction, four sorts of working modes are gradually evolved and proposed for TENGs, as shown in all together cases, oppositely polarized triboelectric charges are often generated on material's surfaces during the contact-electrification process then the electrostatic induction renders a drive for transformation of mechanical stimuli into electric energy when relative motion occurs. supported fundamental physical model of Maxwell's displacement current, the TENGs are often essentially considered a sort of capacitive variable electric-field source, and their output power is proportional to the square of triboelectric charge density.[26,27] that's to mention , the key to enhance TENGs' performance is trying to substantially increase the quantity of generated triboelectric charges. in theory , the greater the difference of electron

Note: This work is partly presented at 1st International Conference on Advanced Energy Materials and Research

affinity between two triboelectric materials is, the more the triboelectric charges are often generated.[17,25] provides a triboelectric series for varied materials ranked consistent with their capabilities of gaining or losing electrons against friction, which may guide researchers to get high output performance for TENGs from the triboelectric material selection point of view.[28-32] Note that the bulk of materials within the list belong to PMs, which possess all kinds of functional groups, like fluorine (□F), cyano radical (□CN), ester group (□COOR), acyl (□CON□), carboxyl (□COOH), and nitro (□NO2) as electron-withdrawing groups, and amidogen (□NH2), amide group (□CONH), oxhydryl (□OH), and alkoxy (□OR) as electron-donating groups. All of those functional groups can play a serious role responsible transfer and charge capturing during contact-electrification process by right of their unique hybrid orbital configurations. Moreover, featuring other merits of superior flexibility, machinability, stretchability, scalability, and low weight, PMs have thus inevitably become the core foundation of the TENGs technology.

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