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Environmental Chemistry 2017: Energy harvesting based on environmentally-friendly perovskite piezoelectric nanofibers - Mohammad Bagher Ghasemian - The University of New South Wales

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Since the first demonstration on nanogenerators using piezoelectric ZnO nanowires for converting mechanical energy into electricity, a great interest has been excited worldwide for developing various approaches for energy harvesting. The key idea of these efforts is the self- powered nanotechnology, aiming at powering nano-devices using the energy harvested from the environment. Compared to the bulk counterpart, the piezoelectric nanofibers have the advantages of lightweight, small-size, high elastic compliance, and high strain tolerance which lead to high sensitivity caused by small and random ambient mechanical movements. Considering the relatively low piezoelectric constant and electromechanical coefficient of ZnO, which potentially hinder the supply of sufficient power for certain applications, energy harvesters based on perovskite piezoelectric materials with high charge constant were suggested. The proposed research aimed at development of energy efficient and environmentally-friendly nanofibers based on emerging lead-free piezoelectric materials. Particular focus was placed on $(Bi_{0.5}Na_{0.5})TiO_3$ system. BNT is known as one of the most important lead-free and strong ferroelectric materials discovered in 1960, which has an ABO_3 distorted perovskite structure. A facile hydrothermal technique was employed and optimized to synthesis the BNT nanofibers. Structural and electrical properties as well as the nanoscale electromechanical response of the nanofibers have been systematically characterized. It is indicated that single crystal BNT nanofibers were synthesized successfully by electrical properties superior and comparable with other one-dimensional piezoelectric materials.

The improvement of inexhaustible and manageable vitality sources dependent on naturally clean materials that can create power by using encompassing copious energies is a significant advance for saving the worldwide condition just as empowering supportable monetary development. The ongoing rise of natural inorganic metal halide perovskite based sunlight based cells has changed photovoltaic innovation with remarkable high paces of intensity transformation efficiencies. Albeit sunlight based vitality is sufficiently high for the vitality reaping, the unexpected changes in natural conditions including climate changes and time-subordinate variables can significantly affect the efficiency of sun oriented cells. Piezoelectric nanogenerators (PENGs) may not deliver higher energies contrasted with sun based energies, however they have been an ongoing point of convergence of research because of their potential capacity to reap vitality from the encompassing condition through biomechanical development. The fundamental trademark highlights of piezoelectric materials, for example, delicate, lightweight, flexible, and eco-accommodating nature permit their more extensive pertinence in an assortment of flexible, wearable and bio-clinical electronic gadgets. These essential highlights force difficulties for inorganic earthenware materials due to their high temperature preparing, weakness and poor mechanical steadiness. Natural inorganic lead halide perovskite materials have as of late got broad consideration for use in different gadgets, for example, photovoltaics, light-discharging diodes (LEDs), and resistive randomaccess memory (ReRAM). Notwithstanding these applications organometal-halide perovskites have as of late been routed to the piezoelectric applications. A far reaching survey on piezoelectric vitality gathering advances was performed by the creators in 2007. In any case, numerous novel methodologies have been created since 2007 so as to improve material properties, transducer designs, electrical interfaces, prescient models, and the application space of piezoelectric vitality gathering gadgets.

This article, as an expansion to the writers' previous survey article, sums up the distributed work on the subject of piezoelectric vitality gathering in the course of recent years (from 2008 to 2018). It ought to be noticed that an immense measure of work has been introduced on piezoelectric vitality reaping in this time frame, which blocks reference of each work, in this manner, this article endeavors to give a brief survey of the most effective investigations in the field. Besides, referred to works are fundamentally confined to peer-looked into diary distributions in request to guarantee quality. Late upgrades in the advancement of little estimated, low-force, versatile, and remote gadgets have prompted the presentation of nonconventional power sources during the recent decades. Batteries are viewed as customary vitality sources yet experience the ill effects of a few confinements, for example, constrained life expectancy and force effectiveness just as restricted vitality stockpiling limit, which requires visit reviving. The idea of gathering vitality from encompassing sources to kill the requirement for batteries or to expand their life has become a significant focal point of scientists. Vitality collecting can possibly expand the working existence of gadgets and

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offers specific application to unavailable hardware or those subject to exorbitant upkeep, for example, tactile hubs in remote areas, embedded wellbeing trackers, biomedical gadgets and huge scope sensor systems Vitality gathering can be characterized as the immediate change of surrounding vitality (mechanical, sun powered, warm, wind, liquid stream, and so on.) to electrical vitality utilizing a specific material or transduction component. A few vitality collecting materials exist, each with an extraordinary transformation system that can be utilized for vitality reaping. Probably the most normal vitality collecting materials incorporate photovoltaics (sun oriented boards) to change over sun based vitality to electric vitality thermoelectrics (thermoelectric generators) to change over temperature differentials into electrical vitality and electromechanical transducers (piezoelectrics, electrostatic generators) to change over mechanical vibration vitality into electrical vitality. Mechanical vibration vitality is normal in numerous conditions where vitality collecting can be valuable. Vibration vitality may exist because of the general condition (for example wind, liquid stream), and furthermore due to operational conditions (for example pivoting hardware). The presence of various wellsprings of vibration vitality is profitable for vibration-based vitality collecting techniques rather than different methods by decoupling stochastic natural impacts from the presentation of the vitality gathering framework.

Biography

Mr. Mohammad Bagher Ghasemian graduated from Iran University of Science and Technology (IUST, Tehran, Iran) in M.Sc. of Analytical Chemistry. Later, as a researcher, he accompanied Smart Supramolecules team at Pohang University of Science and Technology (POSTECH, Pohang, South Korea). In 2015, he was awarded the highly competitive and prestigious International Postgraduate Research Scholarship (IPRS) and joined The University of New South Wales (UNSW, Sydney, Australia) as a PhD student. Synthesizing and characterization of nanomaterials, especially nanoporous, MOF and piezoelectric materials, are the fields of his interest

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