World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:02, 2019

Nanocomposites Based Micro/Nano Electro-Mechanical Systems for Energy Harvesters and Photodetectors

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Abstract : Flexible electronic devices have drawn potential interest and provide significant new insights to develop energy conversion and storage devices such as photodetectors and nanogenerators. Recently, self-powered electronic systems have captivated huge attention for next generation MEMS/NEMS devices that can operate independently by generating built-in field without any need of external bias voltage and have wide variety of applications in telecommunication, imaging, environmental and defence sectors. The basic physical process involved in these devices are charge generation, separation, and charge flow across the electrodes. Many inorganic nanostructures have been exploring to fabricate various optoelectronic and electromechanical devices. However, the interaction of nanostructures and their excited charge carrier dynamics, photoinduced charge separation, and fast carrier mobility are yet to be studied. The proposed research is to address one such area and to realize the self-powered electronic devices. In the present work, nanocomposites of inorganic nanostructures based on ZnO, metal halide perovskites; and polyvinylidene fluoride (PVDF) based nanocomposites are realized for photodetectors and nanogenerators. The characterization of the inorganic nanostructures is carried out through steady state optical absorption and luminescence spectroscopies as well as X-ray diffraction and high-resolution transmission electron microscopy (TEM) studies. The detailed carrier dynamics is investigated using various spectroscopic techniques. The developed composite nanostructures exhibit significant optical and electrical properties, which have wide potential applications in various MEMS/NEMS devices such as photodetectors and nanogenerators.

Keywords : dielectrics, nanocomposites, nanogenerators, photodetectors
Conference Title : ICACME 2019 : International Conference on Advanced Composites and Materials Engineering
Conference Location : Buenos Aires, Argentina
Conference Dates : February 27-28, 2019