



Modeling and experimental verification of polyurethane/lead zirconate titanate composites for Sensing and Actuating Applications

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Abstract

This letter proposes a new model that couples the piezoelectric and electrostrictive behavior to minimize the polarization power of composite polymer. The development of this model that is able to predict the energy harvesting capabilities of an electrostrictive composite. To improve the dielectric permittivity of electrostrictive polymer, the particles of PZT have been incorporated in order to increase the conversion efficiency of composite. Dielectric characterization tests showed an increase in dielectric permittivity by a factor of 4.5 compared to polymer pure. Experimental measurements of harvested power verify the theoretical model and demonstrate a good correlation between two data. An equivalent electrical scheme has been developed, which allows modeling the two behaviors. The harvested power density under low frequency at 2% of strain can reach $0.3\mu\text{W}/\text{cm}^3$ for 33% of PZT without polarization field. The energy harvester property of this material composite has great potential for many self-powered applications such as wireless sensor networks and Internet of things



Biography:

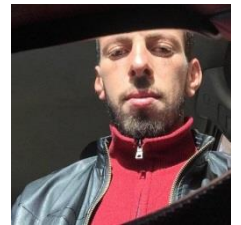
Presently, I am PhD student in Physics at the Faculty of Sciences Ben M'sik University Hassan II Casablanca, Morocco. My thesis topic is Energy Recovery by electro-active materials for autonomous Microsystems. The thesis deals with the study of techniques for exploiting weak energy sources, which is presented everywhere, and essentially for free. With the new emerging technologies of electromechanical transduction, thermoelectric, electroactive polymers have attracted particular attention.

I have completed my Ph.D. degree under the supervision of Dr. Md Mazroui (Professor of Higher Education), Physics of Condensed Matter Laboratory, Department of Physics,

University Hassan II Casablanca, Morocco in 2019. My area of research interest is related to energy harvesting for autonomous Microsystems.

Speaker Publications:

1. R.Farhan, A.Eddiai, M.Meddad, M.Mazroui, M. Rguiti, M. Mazroui, D. Guyomar "Modeling and experimental validation of PU/PZT composites for vibration energy harvesting" Applied Physics Letters (in progress).
2. A.Eddiai, M.Meddad, R.Farhan, M.Mazroui, M.Rguiti, D. Guyomar "Using PVDF Piezoelectric Polymers to Maximize Power Harvested by Mechanical Structure" Superlattices and Microstructures, Vol.127, 20-26,(2018).



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