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### Synthesis and characterization of high energy density piezoelectric ceramic composition for vibration energy harvesting

Vishwas N Bedekar  
Middle Tennessee State University, USA

Recent advancements in wireless sensing technologies have significantly reduced the energy required to operate the sensors. Piezoelectric materials are traditionally used to harvest mechanical vibrations and convert the mechanical energy into electricity. A high energy density piezoelectric composition  $x [\text{Pb}(\text{Zr}_{0.54}\text{Ti}_{0.46})\text{O}_3] - (1-x)[\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3 + y \text{ mol\% MnO}_2]$  [where  $x = 0.7$  to  $0.9$  and  $y = 1$  to  $3$ ] was synthesized and samples were sintered using conventional ceramic processing route. Single and two step sintering profiles were employed. Bimorph energy harvesters were fabricated and tested at resonance frequency ( $\sim 100$  Hz) to record voltage output and power density of these devices. A piezoelectric figure of merit (FOM) was defined in order to compare energy density of compositions. The results of this study clearly showed that performance can be improved with optimization of materials composition, sintering technique, device geometry and device foot print. Micro structural characterization was performed using Scanning Electron Microscopy, Transmission Electron Microscopy and X-ray Photoelectron Spectroscopy. The fabricated devices will be useful to provide portable on-board battery charging solutions harvesting energy from mechanical vibrations.

#### Biography

Vishwas N Bedekar received his Bachelor's degree from University of Bombay, India in 2002. He finished his Master's degree and PhD degree from University of Texas at Arlington, Arlington TX in 2006 and 2009 respectively. His PhD research included synthesis and characterization of piezoelectric and magneto electric materials and devices for sensing and energy harvesting application. He is an Editorial Board Member on Journal of Materials Science Research and is a reviewer on 10 internationally circulated journals. He has published over 30 articles in peer reviewed journals, conference proceedings and presentations. He is currently an Assistant Professor in the Department of Engineering Technology at Middle Tennessee State University. His research interests are synthesis of multifunctional piezoelectric and magneto electric materials, design and development of energy harvesters and self-powered sensing.

[Vishwas.Bedekar@mtsu.edu](mailto:Vishwas.Bedekar@mtsu.edu)