Fabrication and characterization of MEMS-based PZT/PZT bimorph thick film vibration energy harvesters - DTU Orbit (12/04/2019)

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We describe the fabrication and characterization of a significantly improved version of a microelectromechanical system-based PZT/PZT thick film bimorph vibration energy harvester with an integrated silicon proof mass; the harvester is fabricated in a fully monolithic process. The main advantage of bimorph vibration energy harvesters is that strain energy is not lost in mechanical support materials since only Pb(ZrxTi1-x)O3 (PZT) is strained; as a result, the effective system coupling coefficient is increased, and thus a potential for significantly higher output power is released. In addition, when the two layers are connected in series, the output voltage is increased, and as a result the relative power loss in the necessary rectifying circuit is reduced. We describe an improved process scheme for the energy harvester, which resulted in a robust fabrication process with a record high fabrication yield of 98%. The robust fabrication process allowed a high pressure treatment of the screen printed PZT thick films prior to sintering. The high pressure treatment improved the PZT thick film performance and increased the harvester power output to 37.1 μW at 1 g root mean square acceleration. We also characterize the harvester performance when only one of the PZT layers is used while the other is left open or short circuit.

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