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Abstract

Piezoelectric MEMS Energy Harvesters for Powering Sensor Systems †

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For distributed sensing, local power sources are of interest. This is likely to become a progressively more critical problem as the internet of things increases the number of emplaced sensors. This paper will describe energy scavenging using piezoelectric energy harvesters. In this application, a large volume of piezoelectric material with a high figure of merit is essential to obtain a higher power density. The work describes the growth of highly (001) oriented sputtered PZT films ($f \sim 0.99$) exceeding 4 μm in thickness on both sides of a Ni foil to produce a bimorph structure. These films were incorporated in novel resonant and non-resonant harvesters. Novel non-resonant wrist-worn energy harvesters were designed and constructed (<16 cm^2) in which beams are plucked magnetically using an eccentric rotor with embedded magnets to implement frequency up-conversion. The resulting devices successfully convert low frequency vibration sources (i.e., from walking, rotating the wrist, and jogging) to higher frequency vibrations of the PZT beams (100~200 Hz). Measured at resonance, six beams produce an output of 1.2 mW was achieved at a 0.15 G acceleration. For magnetic plucking of a wristworn non-resonant device, 40~50 μW power during mild activity.