Efficient Piezoelectric Energy Harvesters Utilizing {001} Textured Bimorph PZT Films on Flexible Metal Foils

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Extracting energy from low vibration frequencies (< 10 Hz) using piezoelectric energy harvester promises continuous self-powering for sensors and wearables. The piezoelectric compliant mechanism (PCM) design provides a significantly higher efficiency by fostering a uniform strain for its 1st mode shape, and so is interesting for this application. In this paper, a PCM energy harvester with bimorph Pb(Zr, Ti) O_{-3} (PZT) films on Ni foil deposited by rf magnetron sputtering is shown to have high efficiency and large power for low frequency mechanical vibration. In particular, {001} textured PZT films are deposited on both sides of polished Ni foils with (100) oriented $LaNiO_3$ seed layers on HfO_2 buffer layers. The performance of PCM with an active area of 5.2 cm(2) is explored for various excitation accelerations (0.02-0.16 g [g = 9.8 m s(-2)]) around 6 Hz. The PCM device provides a power level of 3.9 mW cm(-2) g(2) and 65% mode shape efficiencies.