Effect of Piezoelectric Later Thickness and Poling Conditions on the Performance of Cantilever Piezoelectric Energy Harvesters on Ni Foils

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Lead zirconate titanate (PZT) films grown on flexible Ni foils were utilized to explore the effects of thickness and poling conditions on the performance of mechanical energy harvesters. In the case of Mn doped 1 mu m thick (001) oriented sol-gel PZT (52/48) films on Ni foil, the dielectric constant and vertical bar e(31,f)vertical bar are 390 at 10 kHz and 11.3 C/m(2), respectively, after hot poling. This film has a large figure of merit ((e2)31,f/epsilon(r)), of around 0.4 C-2/m(4), for piezoelectric energy harvesting. Unimorph cantilever beams were easily fabricated from PZT films on Ni foil using simple mechanical cutting. The maximum power increases from 12 to 60 mu W as the thickness of Nb doped PZT film increases from 1 to 3 mu m at resonance frequency (similar to 70 Hz) at 0.5 G. The optimum poling condition (150 degrees C, at 3 times the coercive for 15 min) enhanced the voltage and power output of the cantilever harvester prepared using (1 mu m) PZT films on Ni foil. It was found that the power performance of harvesters strongly depends on the thickness of the film with resonant harvesters of the same footprint area (0.385 cm(2)) using PZT films on Ni foils.