

FABRICATION AND DESIGN OF MEMS PIEZOELECTRIC HARVESTING GENERATOR BASED ON STAINLESS STEEL SUBSTRATE

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ABSTRACT: In this work we present a novel way to fabricate MEMS piezoelectric harvesting generators. A 304 stainless steel substrate instead of the conventional silicon based substrate was applied to overcome the brittle nature of such devices. The new fabrication process is much cheaper and the substrate material for fabrication is easier to obtain. The nature of stainless steel has better flexibility and the ability to sustain more stress, thus providing a very good substitute to silicon substrate. The piezoelectric material used is the commonly known PZT material, which is deposited on the stainless steel substrate by aerosol deposition method. The area coverage of electrodes has also being tested to determine the sweet spot for optimal performance. Our results has shown that when we have deposit the electrodes from the rigid end of the cantilever beam to the middle point, i.e. 1/2 of the cantilever beam is covered, we have a maximum output. The output performance at {3-1} mode is shown as the following: maximum open circuit output voltage of 4.2 V_{P-P} and a maximum output power of 11 μW with a 2.9 V_{P-P} output voltage at resonant frequency of 213.8 Hz at a 2.9 g acceleration level.

Keywords: power harvesting, MEMS generator, PZT deposition, piezoelectric generator, stainless steel.