Design & Simulation of Various Shapes of Cantilever Beam for Piezoelectric Power Generator

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Abstract

The environs vibration-based Micro electromechanical systems (MEMS) piezoelectric harvester provides a green and virtually infinite alternative power source over traditional energy sources. Here we are using the application in power generator by the help of Microelectromechanical systems (MEMS) which can be refer to devices that have characteristic length of less than 1mm but more than 1 micron, that combine electrical and mechanical components. By using the Structural Mechanics module of COMSOL Multiphysics software, we make the various geometries of the cantilever beam in order to compare displacement and electric potential and hence to calculate the generated power. A layer of piezoelectric material (PZT-5H) is added to the cantilever of specified thickness 0.5 μm and base material as silicon of thickness 1.5 μm and using the Piezoelectric Devices interface of COMSOL Multiphysics. The prototype of E-shaped cantilever shows greatest deflection of 0.6078 μm and the power as 49.05 μW, whereas the T and pie shaped cantilever gives a less piezoelectric voltage of 0.0386 V and 0.0426 V with displacement of 0.5288 μm and 0.3517 μm respectively and the power which generated is as 29.2 μW and 36.29 μW.

Reference

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Figures used in the abstract

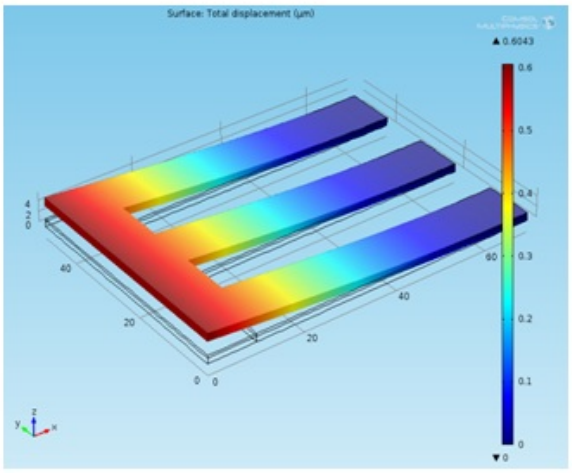

Figure 1: Displacement of E-shaped cantilever.

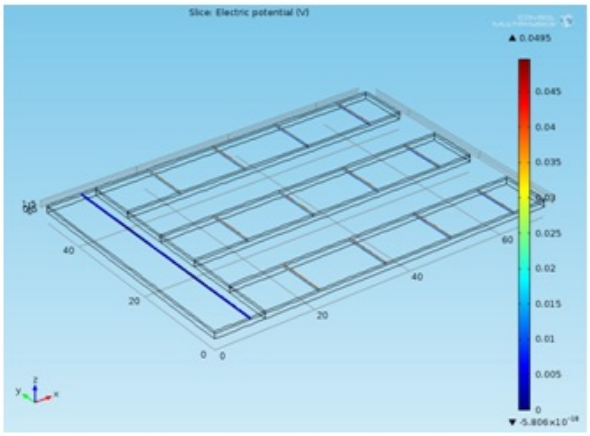

Figure 2: Generated piezoelectric voltage in E-shaped cantilever.

Geometry	Displacement (µm)	Piezoelectric Voltage (V)	Power Generated (µw)
Π shaped	0.3517	0.0426	36.29
T shaped	0.5288	0.0386	29.2
E shaped	0.6078	0.0495	49.05

Figure 3: Comparison of displacement, piezoelectric voltages and generated power for various cantilevers.