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Piezo-electric energy harvesters

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Vibration-based energy harvesting systems have been the focus of many researches in the last 20 years. The most common vibration-based energy harvester consists of a beam with one or two piezoelectric layers. These layers are bounded by electrodes that harvest energy from the produced voltage.

In this work a unimorph cantilever beam is proposed. The equations of vibration are derived and the relation between tip displacement and voltage along its length is deduced. The effects of the beam dimensions and material properties regarding the active and inactive layers on the output power and eigenmodes are also investigated. Finally the theoretical model is validated by using the finite element method software ABAQUS where the results are compared to the experimental data retrieved from a similar work in literature.

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Structural microstructural and magnetic investigations on textured epitaxial NiMnGa thin films on Sapphire (11-20) and MgO (100) substrates

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Ferromagnetic Shape Memory Alloys are promising candidates for sensor and actuator application because of their high recoverable strain and faster response. In the present work the structure, micro-structure and texture of oriented NiMnGa thin films deposited on Al_2O_3 (11-20) and MgO (100) substrates at elevated temperatures by magnetron sputtering are investigated. X-raydiffraction along with pole figure measurement reveals the presence of orthorhombic phase with strong (202) orientation in the film deposited on sapphire (11-20) substrate and (400) orientation on MgO (100) substrates. Nano-twins with 7 modulated twin boundary has been observed in the martensitic plates in transmission electron microscopy investigations. High temperature X-ray diffraction and magnetic measurements were used to investigate the in-situ phase transformations in the film. Both the films have phase transformation temperatures (Martensite-Austenite) near to room temperature which makes them extremely useful for actuator based devices. Field emission scanning electron microscopy (FE-SEM) and rocking curve measurement with high resolution x-ray diffraction reveals uniform microstructure and excellent crystalline quality (low mosaicity) in the films.

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