Piezoelectric polyimide scanning micromirror

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ABSTRACT:

This paper provides an overview of recent research in the use of microelectromechanical systems (MEMS) actuators for optical beam steering applications, including optical coherence tomography (OCT). In the past, prototype scanning devices have been fabricated out of polyimide substrates using conventional MEMS processing technology. The material properties of the polyimide allow very large scan angles to be realized in the devices. The prototype devices utilize piezoelectric bimorphs to mechanically actuate the torsion mirror. Using equipment at the Army Research Lab's Adelphi location these devices were characterized to allow for better modeling of the devices. Analytical models have been developed that predict the resonant frequency of the devices. Further finite element modeling (FEM) has been done using ANSYS. These models closely reflect the measured resonant frequencies of the prototype devices as well as their harmonic behaviors. Based upon these models, further refinements have been made to the design to produce specific resonant frequencies for use in a multitude of applications. These models were then used to design masks for fabrication of new devices. These devices are currently being fabricated on a single wafer with minimal post processing requirements at ARL using a new thin film piezoelectric process. The devices operate at resonant frequencies between 15-60Hz which make them ideally suited for use in applications where real time imaging is desired.

Keywords: Micromirror, Piezoelectric, Polyimide, Optical Coherence Tomography, MEMS

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