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Abstract

A Piezo-MEMS Device for Fatigue Testing of Thin Metal Layers †

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Abstract: Several micro devices, such as micro-mirrors, are subjected to working conditions featuring alternating loadings that can possibly induce fatigue in the thin metal layers, which represent critical structural parts. The quantification of the degradation of the material properties under fatigue loading is a time-consuming task, and the effects of environmental conditions (e.g., humidity) and load characteristics (e.g., frequency, stress ratio) must be properly accounted for. In this work, we propose and assess the efficiency of an on-chip test device based on piezoelectric actuators, able to generate a time-varying (sinusoidal) strain in the mentioned thin metal layers and lead to fatigue. The aim of the research activity is the characterization of the stress/strain-induced degradation process of a thin layer located on the top of a lead zirconate titanate (PZT) actuation system. The characterization has been carried out through measurements of resistivity and roughness, carried out via an ohmmeter and a confocal microscope, respectively. The proposed testing device has shown capability to qualitatively highlight the degradation of the metal layers. A re-design of the on-chip device is also discussed in order to also carry out quantitative evaluations.

Keywords: piezo-MEMS; fatigue; thin metal film

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