Investigation of Top/Bottom Electrode and Diffusion Barrier Layers for PZT Thick Film MEMS Sensors

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ABSTRACT

Micro-electromechanical system (MEMS) devices integrated with thick film PZT, such as accelerometers [1] and ultrasound transducers [2], have gained increased attention throughout the last years. The screen-printing process is quite well suited for miniaturised and integrated devices, but on the other hand, the process of screen printing involves potential problems of thermal matching and chemical compatibility at the processing temperatures between the functional film, the substrate and the top and bottom electrodes. Patterning of the top and bottom electrode is vital in order to design truly functional devices.
In this contribution both screen printing and a lift off process used for patterning the top electrode are investigated (see figure 1). Due to the high sintering temperatures of around 850°C, a diffusion barrier layer between the thick film PZT and the silicon substrate is needed. Evaporated 500 nm Pt have earlier given good results as a diffusion barrier layer and bottom electrode [1]. For some devices, patterning of the bottom electrode is necessary and a nonconducting diffusion barrier layer is needed. ZrO2 layers of various thicknesses have been tested and compared with the conducting diffusion barrier layer. A Sol gel technique has been used to deposited up to 10 layers resulting in a total thickness of 450 nm.

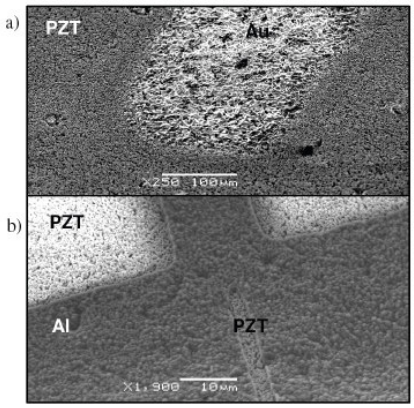

Figure 1: A screen printed Au top electrode (light area in a) and an evaporated Al top electrode (dark area in b) fabricated with a lift off process.

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