High Density PZT Thick Film for MEMS Applications using Cold Isostatic Pressing

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ABSTRACT

During the resent years the development within PZT thick film has found its way to commercial applications including high frequency ultrasound. The applications within high frequency ultrasound is exploiting the thickness coefficients the film which is comparable to bulk PZT. However, many of the ideas initiating the technology platform of PZT thick film came from MEMS technology. For the most part applications for PZT thick film and MEMS technology are based on the bending mode where the in-plane coefficients are used. However, in PZT thick film the in-plane coefficients are generally lower than for bulk. The main reason for this is that the thick film has a porosity of about 20 %. In order to improve the in-plane coefficients it is necessary to decrease the porosity in the thick film material.

In this paper, work with thick film PZT prepared using Cold Isostatic Pressing (CIP) is presented. The PZT thick film is printed using screen printing technology and then pressed at a pressure of up to 2000 bar in order to densify the green film. After pressing the film is sintered and characterised. Two sets of samples have been fabricated using the press. The first set of samples is standard characterisation samples for measurement of thickness coefficients and density and the second set of samples is benders for characterisation of the in-plane coefficients. Also, SEM images of films have been taken for characterisation of the microstructure.

The results from the study show that the density of the final film is increased and is approaching that of bulk PZT. This is indicated by an increase in the relative dielectric constant of 55 % and an increase in density of 31 % for PZT thick film prepared using CIP. From the SEM images it is evident that the porosity of the CIPed film is significantly lower than that of the film prepared in a conventional way.