Wafer mapping of the transverse piezoelectric coefficient, e(31,f), using the wafer flexure technique with sputter deposited Pt strain gauges

Author(s): R.H.T. Wilke[1], P.J. Moses[1], P. Jousse[1], C. Yeager[1], and S.Trolier-McKinstry[1]

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Abstract: Measurement of the transverse piezoelectric coefficient (e(31,f)) in thin films is crucial for the development of microfabricated sensors, actuators, and transducers. Here, a method is described such that lithographically defined strain gauges enable non-destructive, position-dependent characterization of e(31,f) in conjunction with the wafer flexure technique. Measurements of 100 nm thick Pt gauges deposited on 1 mu m thick PbZr0.52Ti0.48O3 thin films yield gauge factors of 6.24, with a gauge-to-gauge variation that is 5% of this value. The system allows for simultaneous measurement of the charge and strain, improving the overall accuracy of measurement. The small footprint of the combined strain gauge array/electrode pattern used for determining e(31,f), allows for a non-destructive mapping of the transverse piezoelectric coefficient across large-area wafers. Due to the clamping configuration used in wafer flexure experiments, e(31.f) values can accurately be obtained within the central similar to 2/3 of a full wafer. Measurements performed on a 1.3 mu m thick randomly oriented polycrystalline PbZr0.52Ti0.48O3 film made deposited on a 4 in. platinized silicon wafer by the sol-gel process show a high degree of uniformity, with e(31,f) of - 6.37 +/- 0.60 C/m(2) for points measured within r =3cm. (C)

Addresses:
1. Penn State Univ, Mat Res Inst, University Pk, PA 16802 USA