**Effects of High Temperature Annealing on the Piezoelectric Properties of Thin Film Aluminum Nitride**

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ABSTRACT

Aluminum nitride (AlN) is an attractive material for the fabrication of MicroElectroMechanical Systems (MEMS) due in part to its piezoelectricity and tolerance to high temperatures. High temperature stability is an essential characteristic for numerous MEMS applications, so it is important to determine how AlN is affected by exposure to high temperatures in an oxygen environment. Annealing AlN thin films at high temperatures causes the surface of the film to oxidize, compromising the piezoelectricity of the film. Energy Dispersive X-Ray Analysis (EDAX) results show that surface oxidation increases linearly as a function of annealing temperature up to 900°C, then increases exponentially until the surface becomes fully oxidized around 1000°C. Using Laser Doppler Vibrometry, we measured the piezoelectric properties of the AlN finding the piezoelectric coefficient to decrease when the films are fully oxidized. EDAX measurements show that depositing a thin layer of silicon nitride ($Si_3N_4$) on top of AlN protected the sample from becoming fully oxidized at high temperatures. This presentation shows the relationship between piezoelectricity and surface oxidation of sputtered and MOCVD-grown thin film AlN on a Si substrate and explores methods used to protect AlN from surface oxidation and preserve its piezoelectric properties such as temperature cycling and $Si_3N_4$ capping.