Tunneling in Aluminum Nitride Thin Films and Multilayer Stack Structures

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ABSTRACT

Aluminum nitride (AlN) is a wide bandgap material that is being investigated for piezoelectric and high temperature applications. While the piezoelectric response is still much lower than that of more common piezoelectric materials such as lead zirconate titanate or zinc oxide, a method of maximizing the piezoelectric response of AlN has been explored by depositing stack structures composed of alternating AlN and platinum layers. These stack structures were created by depositing a thin, ~50nm, metal layer in between thicker, ~150-350nm, layers of the piezoelectric film. Platinum was chosen as the metal interlayer due to the tendency of AlN to become highly c-oriented when deposited on Pt.

An electric field was applied across the structure and displacements were measured using a Laser Doppler Vibrometer. AlN thin films and stack structures were found to be conductive when measuring the displacement despite the dielectric properties of the material. I-V measurements as well as Fowler-Nordheim theory and plots were applied to investigate tunneling due to high electric fields in the structures.