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Analysis of multilayered, nitrogen-doped aluminum oxide and hafnium oxide dielectric films for wide-temperature capacitor applications

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Abstract

Capacitors with stable dielectric properties across a wide temperature range are a vital component in many power conditioning applications. High breakdown strength and low loss are also important for many applications. In this study, the dielectric properties of multilayer nitrogen-doped aluminum oxide and hafnium oxide films were characterized, comparing their properties to single layer films. The films were found to be stable from -50 to 200 °C and from 20 Hz to 1 MHz. An order of magnitude decrease in leakage current was observed for the bilayer films. Breakdown strength for the multilayer films increased up to 75%. This concurs with the hypothesis that the addition of dielectric interfaces provides area to trap and dissipate runaway charge moving through the dielectric, thus lowering leakage current and increasing the breakdown strength.

Keywords: wide temperature, capacitor, dielectric, hafnium oxide, aluminum oxide

1.1 Introduction

Capacitors are a vital component in many power conditioning applications. Their main purpose is to mediate current fluctuations in an electrical circuit in order to provide a load with a

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