

**On the Dielectric Properties of 0.30 BaO – 0.45 B₂O₃ – 0.25ZnO and
0.50 PbO – 0.40 SiO₂ – 0.10 Al₂O₃ Alkali-Free Glass in Bulk and Film
Forms**

by

Carl Busta

A Thesis Submitted to the Graduate
Faculty of Rensselaer Polytechnic Institute
in Partial Fulfillment of the
Requirements for the degree of
MASTER OF SCIENCE
Major Subject: Materials Science and Engineering

Approved:

Doug Chrisey, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York
December 2011

ABSTRACT

The dielectric constant and impedance values for 0.30 BaO – 0.45 B₂O₃ – 0.25 ZnO alkali-free glass and 0.50 PbO – 0.40 SiO₂ – 0.10 Al₂O₃ alkali-free glass were calculated. The capacitors were fabricated in a parallel plate capacitor configuration with a film thickness of 600nm and bulk thickness of 0.6 – 0.9mm. The dielectric constant of the bulk borate glass is 9.8 and for the bulk lead glass is 17.1. The glasses were deposited onto metallized MgO (100) substrates using Pulsed Laser Deposition (PLD) using a 248nm KrF excimer laser with a fluence of 3.2-3.8J/cm². The deposited borate glass formed a porous and under-dense layer that crystallized when annealed to sinter. The deposited lead glass formed a uniform and pore free microstructure with the calculated dielectric constant varying from 24 to 28. These results show the potential of glass ceramic composites for large-scale energy storage.