Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Effect of Organic Blocking Layer on the Energy Storage Characteristics of High-Permittivity Sol-Gel Thin Film Based on Neat 2-Cyanoethyltrimethoxysilane YUNSANG KIM, MOHANALINGAM KATHAPERUMAL, Georgia Inst of Tech, MING-JEN PAN, Naval Research Laboratory, JOSEPH PERRY, Georgia Inst of Tech — Organic-inorganic hybrid sol-gel materials with polar groups that can undergo reorientational polarization provide a potential route to dielectric materials for energy storage. We have investigated the influence of nanoscale polymeric layer on dielectric and energy storage properties of 2-cyanoethyltrimethoxysilane (CNETMS) films. Two polymeric materials, fluoropolymer (CYTOP) and poly(p-phenylene oxide, PPO), are examined as potential materials to control charge injection from electrical contacts into CNETMS films by means of a potential barrier, whose width and height are defined by thickness and permittivity. Blocking layers ranging from 20 nm to 200 nm were deposited on CNETMS films by spin casting and subjected to thermal treatment. Polarization-electric field measurements show 30% increase in extractable energy density with PPO/CNETMS bilayers, relative to CNETMS alone, due to improved breakdown strength. Conduction current of the bilayers indicate that onset of charge conduction at high field is much delayed, which can be translated into effective suppression of charge injection and probability of breakdown events. The results will be discussed in regards to film morphology, field partitioning, width and height of potential barrier, charge trapping and loss of bilayers.

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Date submitted: 15 Nov 2013 Electronic form version 1.4