Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Dielectric Breakdown in Filled Silicone Elastomers at the Particle/Matrix Interface[1] ROGER DIEBOLD, School of Engineering and Applied Sciences, Harvard University; Materials Department, University of California, Santa Barbara, MICHAEL GORDON, Chemical Engineering Department, University of California, Santa Barbara, DAVID CLARKE, School of Engineering and Applied Sciences, Harvard University — Silicone elastomers, widely used as electrical insulators and potting agents, are typically filled with large amounts of fumed silica nanoparticles to enhance their mechanical strength and toughness. It is well known that as the filler particle diameter decreases to the nanometer length scale, the interfacial surface area to volume ratio increases dramatically, consequently determining many of the physical properties of the macroscopic composite. Thus, to understand electrical breakdown in these materials, it is imperative to investigate the interface between the filler particle and the bulk elastomer. In order to eliminate some of the complexities of studying dielectric breakdown at the filler/matrix interface, it is necessary to remove particle-particle interactions. In this paper, the authors will present ‘creep’ (surface) and ‘strike’ (through-thickness) dielectric breakdown results at idealized oxide/polymer interfaces which closely emulate those found in filled elastomer systems. Weibull and I-V curve analysis will be used to describe the effects of silane coupling agent functionalization on dielectric breakdown, and in particular, how different chemical moieties play a role in high-field interfacial electronic transport.

[1] Funding: MRSEC program under NSF award no. DMR-0820484. Nanofabrication facilities: CNS (Harvard) and UCSB, part of the NNIN network, supported under NSF award no. DMR-0820484.

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Date submitted: 28 Nov 2011 Electronic form version 1.4