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Dielectric Performance of Matrix Free, Hairy Nanoparticle Films[1] CHRISTOPHER GRABOWSKI, ELIZABETH OPSITNICK, HILMAR KOERNER, MICHAEL DURSTOCK, RICHARD VAIA, Air Force Research Laboratory — Addressing the increasing electrical energy storage and power delivery needs of industry has driven development of novel insulating materials. The voltage breakdown characteristics of two-component polymer nanocomposites (PNCs) – nanoparticles dispersed in a polymer matrix – have been previously explored. Control of morphology and dispersion is challenging, however, due to aggregation at high inorganic fractions ($> 5\%$ v/v). To fully establish the potential of these nanostructure hybrid materials, we examine the dielectric performance of matrix free, hairy nanoparticle films. These single-component PNCs are comprised of silica nanoparticles with a polystyrene corona such that coronas of adjacent nanoparticles interpenetrate and entangle. Grafting the polymer directly to the nanoparticle provides certain benefits, including more uniform/predictable film morphologies and higher achievable nanoparticle loading. Energy storage capabilities will be assessed from dielectric experimental methods, which include measuring the characteristic dielectric film strength and dielectric permittivity for varying volume fractions of silica.

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