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Orientationally Ordered Lamellar Block Copolymer Films for Electrostatic Capacitor Applications CHRISTOPHER GRABOWSKI, Air Force Research Laboratory, SAUMIL SAMANT, ALAMGIR KARIM, Univ. of Akron, MICHAEL DURSTOCK, Air Force Research Laboratory — Improving the maximum operating voltage of an electrostatic capacitor requires materials that can better suppress breakdown initiation and/or forestall breakdown propagation. Progress has been made in developing layered architectures through polymer co-extrusion and inorganic nanolaminates, which create tortuous pathways to the applied electric field, resulting in increased breakdown strength. Block copolymer films provide another route to achieve such layered structures, while allowing more control over orientation, domain size, and morphology. We report the dielectric performance of micron-thick linear diblock copolymer films consisting of polystyrene-b-poly-2-vinylpyridine and polystyrene-b-poly methyl methacrylate, focusing on molecular weight ratios that yield lamellar and spherical morphologies. Specialized techniques such as cold-zone soft shear annealing allow for the precise control of lamellae orientation (layering parallel or perpendicular to the applied electric field). Our results indicate dielectric breakdown performance for parallel ordered lamellae is greater than comparable perpendicular lamellae and as-cast films with no induced microphase separation, which we attribute to the presence of interfacial layers that act as barriers to the applied field.

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