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Block Copolymer nanocomposite thin films for high energy-density capacitors SAUMIL SAMANT, University of Akron, SHIMELIS HAILU, Howard University, CHRISTOPHER GRABOWSKI, MICHAEL DURSTOCK, Air Force Research Lab, DHARMARAJ RAGHAVAN, Howard University, ALAMGIR KARIM, University of Akron, UNIVERSITY OF AKRON COLLABORATION, HOWARD UNIVERSITY COLLABORATION, AIR FORCE RESEARCH LAB COLLABORATION — The energy storage capacity of solid-state capacitors is governed by product of relative permittivity (ε) and square of breakdown strength (Vbd) of dielectric medium. Polymer films are widely used as the dielectric medium in capacitors due to their high Vbd and low loss but they suffer from poor permittivities. Composite dielectrics combine the high ε ceramic fillers with high Vbd polymer matrix but usually result in loss of Vbd due to aggregation induced field enhancements. For optimum enhancement of dielectric properties, it is essential to improve matrix-filler interaction and control the dispersion of fillers. To that effect we graft a BCP onto the nanofiller and disperse it within a host BCP with similar composition. Using Directed Self-assembly we fabricate BCP nanostructured films with highly dispersed functionalized nano-fillers that are not only expected to enhance the overall ε, but the well-ordered BCP nanostructures also improve Vbd by providing sharp interfacial barriers acting as charge traps. The impact of filler functionalization, BCP morphology and nanofiller loading on dispersion and capacitor performance will be reported.

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