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(Electro)Mechanical Properties of Olefinic Block Copolymers

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Conventional styrenic triblock copolymers (SBCs) swollen with a midblock-selective oil have been previously shown to exhibit excellent electromechanical properties as dielectric elastomers. In this class of electroactive polymers, compliant electrodes applied as active areas to opposing surfaces of an elastomer attract each other, and thus compress the elastomer due to the onset of a Maxwell stress, upon application of an external electric field. This isochoric process is accompanied by an increase in lateral area, which yields the electroactuation strain (measuring beyond 300% in SBC systems). Performance parameters such as the Maxwell stress, transverse strain, dielectric breakdown, energy density and electromechanical efficiency are determined directly from the applied electric field and resulting electroactuation strain. In this study, the same principle used to evaluate SBC systems is extended to olefinic block copolymers (OBCs), which can be described as randomly-coupled multiblock copolymers that consist of crystallizable polyethylene hard segments and rubbery poly(ethylene-co-octene) soft segments. Considerations governing the development of a methodology to fabricate electroresponsive OBC systems are first discussed for several OBCs differing in composition and bulk properties. Evidence of electroactuation in selectively-solvated OBC systems is presented and performance metrics measured therefrom are quantitatively compared with dielectric elastomers derived from SBC and related materials.