Structural Changes in Block Copolymers: Coupling of Electric Field and Mobile Ions

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We argue that the presence of dissociated ions in block copolymers under electric fields can induce strong morphological changes and even lead to phase transitions. We investigate, in particular, diblock copolymers in the body centered cubic (bcc) phase. In pure dielectric materials (no free charges), a dielectric breakdown is expected to occur for large enough electric fields, preempting any structural phase transition. On the other hand, dissociated ions are predicted to induce a phase transition to a hexagonal array of cylinders, at fields of about 10 V/μm or even lower. The strength of this mechanism can be tuned by controlling the amount of free ions present.

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