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Orientation control of cold zone annealed Block copolymer films on tunable gradient surface energy substrates using combinatorial methods MANISH KULKARNI, GURPREET SINGH, ALAMGIR KARIM, The University of Akron — Microphase morphologies of poly(styrene)-block-poly(methylmethacrylate) (PS-PMMA) block co-polymer (BCP) films coated on various tunable surface energy gradient (SEG) substrates were compared. Substrates were prepared by coating silane self assembled monolayer (SAM) and hydrophobic sol-gel based layer of silica (xerogel) on quartz and exposed to UV-ozone radiation by placing them on an accelerating stage that oxidizes the surface to generate SEG. The combinatorial thickness gradient samples of BCP film were prepared by flow coating the BCP solution orthogonal to the SEG. Samples were annealed using novel cold zone annealing (CZA) method with a sharp thermal gradient (50 ^{o}C/mm) to obtain highly ordered BCP morphologies. Effect of CZA annealing rate and film thickness on BCP morphologies of the SAM treated and untreated quartz as well as xerogel substrates were compared. It was observed that BCP films coated on the untreated quartz substrates exhibited hexagonally packed perpendicular cylindrical morphologies whereas higher area fraction of parallel cylinders was observed for SEG xerogel substrates for higher surface energies (>40 mJ/m^2). BCP 2D surface morphologies studied using AFM, were confirmed to extend to the interior of the film (3D) by GISAXS.

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