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Direct Observation of the BCC (100) Plane in Thin Films of Sphere-forming Diblock Copolymers SHENGXIANG JI, UMANG NAGPAL, WEN LIAO, JUAN DE PABLO, PAUL NEALEY, University of Wisconsin, Department of Chemical & Biological Engineering — In sphere-forming diblock copolymers, periodic arrays of spheres are arranged in a body-centred cubic (BCC) lattice structure in bulk. However, in thin films different surface morphologies were observed as a function of the film thickness, and the transition from the hexagonal array to the BCC (110) arrangement of spheres on film surfaces was located with respect to the increase of the film thickness. Here we report the first direct observation of the BCC (100) plane in thin films of poly (styrene-*b*-methyl methacrylate) diblock copolymers on homogeneous substrates. By balancing the surface energies of both blocks, the lower energy BCC (100) plane corresponding to a square arrangement of half spheres, formed on film surfaces when the film thickness was commensurate with the spacing, L_{100}, between (100) planes or greater than 2 L_{100}. A hexagonal arrangement of spheres was only observed when the thickness was less than 2 L_{100} and incommensurate with 1 L_{100}. Monte Carlo (MC) simulation confirmed our experimental observation and was used to investigate the transition of the arrangement of spheres as a function of the film thickness.

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