AFM experiments were performed using an Asylum Research MFP-3D atomic force microscope in AC Topography/tapping mode. AFM cantilevers used in imaging were either Budget Sensors Tap300 G, Oxford Instruments HQ-75-Au, or Oxford Instruments HQ-300-Au cantilevers with typical tip radii of curvatures of about 10 nm. Samples for AFM were prepared on coverslips that were cleaned with isopropanol with subsequent plasma cleaning or using an acid bath. Polymer solutions (180 mL of ~2.0 wt %) were spun cast under a nitrogen atmosphere (500 rpm for 5 s, then 2000 rpm for 60 s) and resulted in ~150 nm thick films. For solvent annealing, a sample was placed in an argon filled 270mL jar away from direct solvent contact. Dichloromethane (0.5 mL) was added to the bottom of the jar and capped tightly for ~ 60e75 min. After solvent vapor annealing, the sample was placed in an active vacuum to remove residual solvent vapor prior to imaging.

P-38 (a), P-47 (b), P-48 (c), P-58 (d), P-61 (e), and P-70 (f)
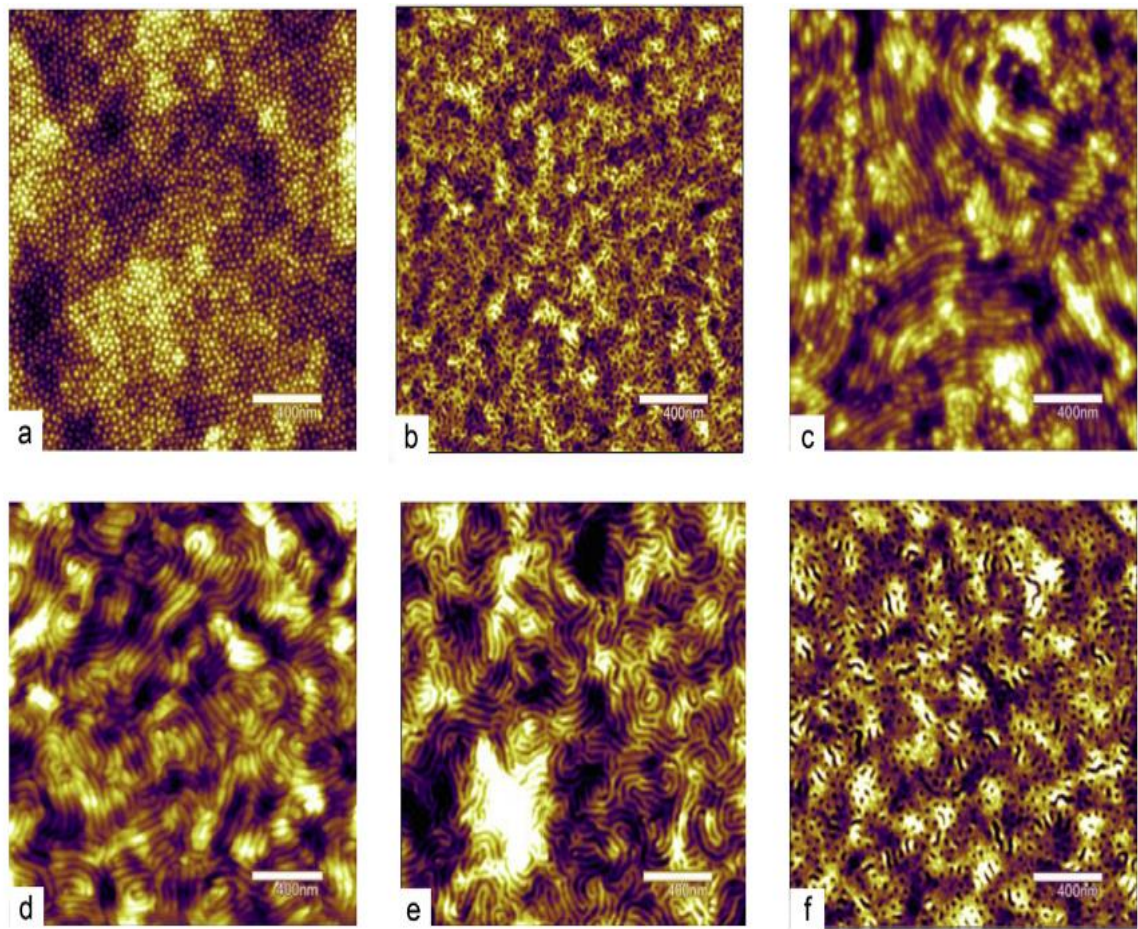
The resulting images for samples P-38, P-47, P-48, P-58, P-61, and P-70 are presented in Fig. 3. The ONDI-ph block weight fractions of these sample range from 0.38 to 0.70. For all AFM images, the false color scale indicates relative height where yellow is high and black is low. The height topography of the domains observed cover approximately 10 nm from the top to bottom of a domain feature excluding larger scale surface roughness. The high areas are rich in the ONDI-ph block and the low areas are rich in ONDI-12 block. The morphology for both samples P-38 (a) and P-70 (f) show cylinders apparently oriented perpendicular to the surface. The former image shows a higher degree of order with even some hexagonal packing regions, while the latter image shows some cylinders at different orientations indicating less order. Samples P-58 (d) and P-61 (e) both appear to demonstrate a lamellar morphology perpendicular to the surface. If the lamellae were parallel to the surface, they would image as a flat surface. The last two images, P-47 (b) and P-48 (c), both appear to be in transition from cylinders to towards lamellae as one would expect with the former showing what appear to be more disordered cylinders with short range order despite the SVA. The latter image appears to showsignificantly better order with what appears to domains of cylinders and other areas appear more lamellae-like.

The block copolymers were found to have high salt solubility (up to ~50 wt %) relative to the ONDI-12 block for some copolymer weight fractions. Both neat copolymers and copolymers with LiTFSI were able to develop significantly ordered structures, however, solvent vapor annealing was key to develop longer range ordering. Block copolymers with both LiTFSI and SVA had increased ordering compared to only SVA. The morphologies observed primarily included cylinders and lamellae with a wider weight fraction region of lamellar structures in the AFM samples with ~33 wt % LiTFSI.