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Ordered and Disordered Polymerized Ionic Liquid Block Copolymers: Morphology and Ionic Conductivity SHARON WANG, Materials Science and Engineering, University of Pennsylvania, YUESHENG YE, YOSSEF ELABD, Chemical and Biological Engineering, Drexel University, KAREN WINEY, Materials Science and Engineering, University of Pennsylvania — We systematically studied the influence of temperature and relative humidity on morphology and ionic conductivity in polymerized ionic liquid block copolymers (PIL BCP). Poly(methyl methacrylate-*b*-1-[2-(methacryloyloxy)ethyl]-3-butylimidazolium-X^-) block copolymers (X^- = OH^-, Br^-) were characterized by SAXS, dynamical mechanical analysis, and electrochemical impedance spectroscopy. At 25 $^\circ$C, weak microphase separation was observed for the PIL BCP with ϕ_{PIL} = 0.38 and X^- = OH^-. Upon increasing the relative humidity to 90%, this polymer exhibited an order-disorder transition (ODT). The ODT was further studied in the PIL BCPs with X^- = OH^- and 0.11 $<\phi_{PIL}<$0.38 over a range of temperatures and %RH. In contrast, the PIL BCP with ϕ_{PIL} = 0.38 and X^- = Br^- formed strongly microphase separated lamellae at all investigated T and %RH. At elevated temperature and 90 %RH, ionic conductivities of 30 and 6 mS/cm were observed for ϕ_{PIL} = 0.38 and X^- = OH^- and Br^-, respectively, surpassing the conductivities of the corresponding PIL homopolymer. By selecting the counterion and relative humidity, we significantly impact the morphology and ionic conductivity of these PIL block copolymers.

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