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Recent instrumentation advances offer new opportunities in electron microscopy of polymers

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Imaging of polymers by transmission electron microscopy (TEM) or scanning transmission electron microscopy (STEM) remains a challenge due to the low contrast between domains and sensitivity to the electron beam. Recent advances in instrumentation for electron microscopy have aimed to push the resolution limit, leading to remarkable instruments capable of imaging at 0.5 Å. But, when imaging soft materials, the resolution is often limited by the amount of dose the material can handle rather than the instrumental resolution. Despite the strong constraints placed by radiation sensitivity, recent developments in electron microscopes have the potential to advance polymer electron microscopy. For example, monochromatated sources enable spectroscopy and imaging based on the valence electronic structure, aberration correctors enable imaging of thick films, direct electron detectors minimize the required dose for imaging, and differential phase contrast imaging can map heterogeneities in electric fields within films. Altogether, the field of polymer electron microscopy is poised to make significant advances in the near future.