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**Minimizing beam damage in the electron microscope to enable new imaging approaches for conjugated polymers** BROOKE KUEI, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA 16802, USA, ENRIQUE D. GOMEZ, Department of Chemical Engineering, Materials Research Institute, The Pennsylvania State University, University Park, PA 16802, USA — Transmission electron microscopy (TEM) of conjugated polymers has remained a challenge because resolution is limited by the electron dose the sample can handle. We have characterized the effects of beam damage on poly(3-hexylthiophene) (P3HT) and poly[(5,6-difluoro-2,1,3-benzothiadiazol-4,7-diyl)-alt-(3,3"'-di(2-octyldodecyl)-2,2';5',2";5",2"'-quaterthiophene-5,5"'-diyl)] (PffBT4T-2OD) via electron diffraction and scanning TEM electron energy-loss spectroscopy (STEM-EELS). Critical dose $D_C$ values were calculated from the decay of diffraction and low-loss EELS peaks as a function of dose rate, accelerating voltage, and temperature. Importantly, $D_C$ increases with dose rate in the low dose rate regime, likely due to the limited diffusion of ions. STEM-EELS spectrum imaging also revealed that damage occurs even in areas untouched by the beam. Altogether, our results suggest that although local heating can be important, other factors such as the dose rate must also be tuned to minimize beam damage.

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