Electron diffraction and electron energy-loss spectroscopy of pharmaceutical materials

Ralm G. Ricarte, Timothy P. Lodge, and Marc A. Hillmyer

Transmission electron microscopy techniques are powerful tools for revealing detailed structural information of materials. In particular, electron diffraction and electron energy-loss spectroscopy (EELS) provide considerable insight into the nanostructure and behavior of chemical species due to the high spatial resolution. These techniques, however, are rarely used to study soft matter because the electron beam damages the structure of these substances. In this talk, we demonstrate the use of electron diffraction and EELS on blends of hydroxypropyl methylcellulose acetate succinate (HPMCAS), a polymer excipient, and various active pharmaceuticals. First, we use low-dose conditions to preserve the structure of the blends during the experiments. Next, we use electron diffraction to detect drug crystallites in the blends with high spatial resolution and a detection sensitivity that is superior to traditional techniques (e.g., WAXS and DSC). Finally, we use EELS to measure quantitatively the concentration of drug and polymer in the blend with sub-100 nm resolution. We propose that this analytical strategy may be a potent tool for characterizing many soft matter materials.

Biography

I grew up in the small cattle town of Kingsville, TX. I earned a B.S. in chemical engineering from The University of Texas at Austin in 2011. Currently, I am a 5th year graduate student in the groups of both Marc Hillmyer and Tim Lodge. In addition to research, I founded and co-chair The Science For All Outreach Program, a non-profit group dedicated to teaching science to the urban Twin Cities community. Outside of work, I enjoy photography, pub trivia, and playing bass (poorly) in various bands.