Advanced Electron Microscopy Study of Energy Materials

Shize Yang, Director, ACEM Core, Yale University

Electron microscopy is powerful tool for materials science research with versatile operation modes including TEM, STEM, EELS, EDX, ptychography, tomography and holography etc. In this talk, I will use a few examples to demonstrate how I apply these advanced techniques to resolve the atomic structure of materials to understand the property of energy materials. For example, I used atomic STEM imaging to monolayer 2D materials and discovered the special diffusion mechanism through local atomic pair exchange [1]. Chemical composition and structure can be revealed and determined at atomic level through STEM ADF imaging [2] which help design better catalysts. I carried out atomic reconstruction on these atomic layers [3] to reveal the atomic coordinates in 3D. I used STEM imaging technique to reveal the structural feature in thin layers of PdSe₂ [4] and identified a new structure of Pd₁₇Se₁₅ [5]. I also want to use two example to show the importance of using complimentary techniques to better resolve structure and its correlation with property [6, 7]. Since the new Spectra Ultra TEM at Yale will have an atto-light CL system, I would like to briefly discuss my CL work on ZnO during PhD [8]. I will briefly talk about using in-situ probe holder for battery study [9].

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