DEPARTMENT OF
Chemistry
UNIVERSITY OF WISCONSIN-MADISON

Ph.D. Dissertation Defense

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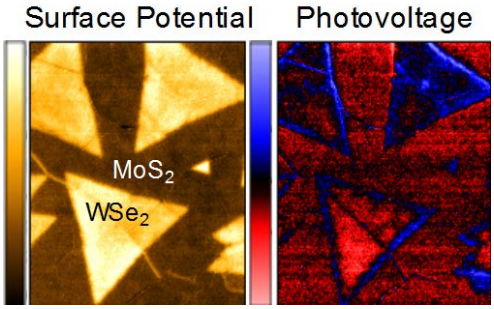
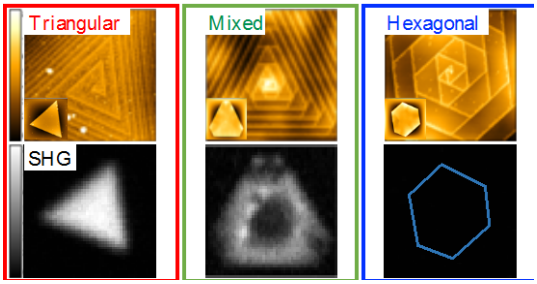
Bob Hamers & Song Jin Research Groups

"Correlating Spatial Heterogeneity with Electronic and Optical Properties of Transition Metal Dichalcogenides"

Transition metal dichalchogenide (MX_2) nanomaterials are useful for a variety of applications ranging from optoelectronics to photovoltaics; however, spatial heterogeneity in composition, physical structure, and/or topography give rise to non-uniform properties that hinder the application of these materials. In this talk, I will discuss my work studying the effects of spatial heterogeneity on MX_2 nanomaterials, particularly WSe_2. I will describe the effect of screw dislocation-driven growth of WSe_2 nanoplates on layer stacking. By correlating shape of the spiral growth to different electronic and optical properties of these nanoplates, I developed a robust method for determining layer stacking and revealed previously undemonstrated stackings for this material. I will also discuss my implementation of the technique surface photovoltage-Kelvin probe force microscopy as a means for understanding charge accumulation and charge transfer in nanomaterials. I demonstrated the viability of this technique on a MoS_2-WSe_2 lateral heterostructure, a p–n junction with potential applications in photovoltaics. I mapped charge separation at this junction on the nanoscale by measuring surface charge accumulation upon sample exposure to visible light, and I studied variation in charge transfer between different heterostructure flakes.





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