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NANOLUND

AT THE FOREFRONT OF NANO SCIENCE

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NANOSCIENCE COLLOQUIUM

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In Situ Microscopy Studies of 2D Layer Growth Kinetics and Structure-Property Relations

In situ microscopy studies with high spatial and temporal resolutions are ideally-suited for quantitative description of factors controlling morphological, structural, and compositional evolution in materials and often reveal surprising and previously unknown aspects about the materials. In this talk, I will showcase the use of *in situ* high-temperature scanning tunneling microscopy (STM) and low-energy electron microscopy (LEEM) to investigate two-dimensional (2D) layered materials such as graphene an**d** hexagonal boron nitride (hBN).

The newly emerging class of 2D materials exhibit a wide range of properties (e.g., graphene is metallic, h-BN is insulating, and MoS_2 is semiconducting) and are attractive for opto- and nano- electronic applications. Recent efforts have focused on vertical integration of 2D layers of dissimilar materials (e.g., graphene/h-BN and graphene/MoS_2). In these heterostructures, due to relatively weak vdW interactions, orientational registry between the layers is not expected and is often difficult to control. Using a combination of STM, LEEM, and density functional theory (DFT) calculations, we investigated the growth kinetics and electronic properties of monolayer graphene on metal (Pd), graphene on graphene, and hBN on Pd. We determined the graphene growth kinetics and orientation-dependent variations in surface work functions. Our studies provide important insights into the role of interface structure on the electronic properties of 2D layered materials.

Host: Kimberly Dick Thelander (Solid State Physics)