CENIDE & WIN Seminar Series on 2D-MATURE

DFG IRTG 2803 & NSERC CREATE

Kerstin Volz

Philipps-University Marburg

“2D materials: from scalable MOCVD growth to quantitative structural characterization at the atomic scale”

April 20th, 2023
10:00 a.m. ET / 16:00 p.m. CET

Kerstin Volz is a Heisenberg professor (full professor) for experimental physics at *Philipps-Universität Marburg/Germany* since 2009 and heads the Materials Sciences Center there.
She received her diploma in physics from *Augsburg university* in 1996. In 1999 she obtained her PhD from the same university. After several research visits at *Osaka National Research Institute/Japan* and *Nagasaki Institute of Technology/Japan* and a postdoctoral stay at *Stanford University/USA* she joined *Philipps-Universität Marburg* as a Junior Group leader. After a professorship at the *Humboldt-Universität zu Berlin*, she was appointed as a professor in Marburg. She served as speaker of the Research Training Group “Functionalization of Semiconductors” (2012-2022) and currently is the spokesperson of the Collaborative Research Center “Structure and Dynamics of internal Interfaces, both financed by the German Research foundation (DFG). She received the following awards: Graduate Student Award of EMRS (1996); Feodor-Lynen scholarship of Alexander von Humboldt foundation (2001); guest professorship of Humboldt Universität zu Berlin (2008); Heisenberg professorship of German Research Foundation (2008); Patricia Pahamy Price for best teaching (2009); Greve-prize of the Leopoldina (2022).
Her research interests include the synthesis (MOVPE) and quantitative transmission electron microscopy of novel functional materials.

Two-dimensional materials are prime contenders to enhance semiconductor technology. Their rich compositional and stacking varieties yield virtually endless possibilities to tailor device properties. For example, monolayer GaS exhibits a bandgap in the ultraviolet and could yield solar-blind photodiodes or even replace GaN as emitter in LEDs covering the whole visible spectrum.
However, any commercial success requires wafer-scale integration rather than growth or fabrication without upscaling possibilities like, e.g., exfoliation. Here we show that metal organic chemical vapor deposition allows a one-step growth process of monolayer GaS on sapphire substrates and reveal the interface chemistry and resulting epitaxial relationship. Pulsed-mode deposition of industry-standard precursors drastically inhibits vapor-phase pre-reactions and fosters monolayer growth. Structure-revealing and composition-sensitive probes confirm the quality and monolayer properties. To this end, we employ various sophisticated transmission electron microscopy-based methods to quantify defects, the atomic reconstruction as well as charge redistribution and electronic excitations in monolayer as well as twisted (hetero)bilayer 2D materials.