

Kumulative Habilitation von Dr.rer.nat. Patrick Vogt

Title: Surfaces of Solids for the adsorption of organic molecules

Abstract

The present study focuses on the preparation of semiconductor surfaces and novel two-dimensional materials and their functionalization by adsorption of organic molecules.

A detailed understanding of the interface formation of these hybrid systems could be achieved by combining complementary experimental techniques with results from *ab initio* theory (in cooperation with theory groups).

The well-investigated and well-understood surfaces of the classical semiconductors GaAs and InP were used to study the interface formation with small heterocyclic ring-molecules. The obtained results demonstrate that numerous properties, either of the semiconductor surface or the organic molecules, influence significantly the bonding configuration: the dimer-structure of the substrate surface, the aromaticity and number of double bonds of the molecule, the role of surface defects, surface electric fields and band banding and the surface induced growth-mode of thin organic layers.

With this knowledge the investigation focused on the preparation of novel surfaces structures, e.g. of the technologically important group-III nitrides (InN, I(Ga)N). The related work ranged from improving the growth of In(Ga)N on sapphire by optimizing the nitridation process to non-destructive *in situ* determination of the polarity and finally the preparation of well-defined surface reconstructions.

Beside these pure surfaces structures the work also concentrated on the new class of 2D materials, such as silicene. We could demonstrate for the first time that silicene can be synthesized on Ag(111) and determine the related structural and electronic properties. These results pave the ground for future functionalization by organic molecules.