Chapter 9

Summary

The objective of this work was to make experimentally use of the first aberration corrector for low energy electron microscopes. It has been shown for the first time that with tetrode mirror it is possible to compensate simultaneously for both the spherical (see figure 4.5 on page 36) and chromatic aberrations (see figure 4.7 on page 38) of a spectro-microscope. Currently, the energy resolution of the imaging energy filter is the best available (see figure 4.9 on page 40).

The investigation of organic layers, in this case PTCDA on a Ag(111) surface, as a test platform for future high resolution studies, has been microscopically and in real time characterized with a variety of methods (chapter 5 on page 41). Successively, basic growth parameters have been systematically investigated and correlated. The morphology of the substrate surface has been shown to strongly influence the nucleation process of the first PTCDA layer. Step bunches and areas with high step density act as nucleation centers and therefore increase the island density (see figure 6.4 on page 72). This influence of the substrate morphology on the nucleation density is reduced for higher layers and negligible for the 3D islands. Furthermore, we could correlate the substrate morphology with the growth direction of the islands (see figure 6.5 on page 74) and with the growth mode (see figure 6.6 on page 76). These findings associate the effects that steps and step bunches exert on the growth. This supports the statement that the interface between the growing organic film and the substrate determines dominantly the structural, morphological and electronic properties of the film.

Based on the real-time microscopic observation, the growth mode transition has been correlated with the presence of metastable layers during growth (see chapter 7 on page 79). A 1D-model has been suggested to describe the metastable layers.

Conclusively, the properties of the organic layers have been probed with *in-situ* photoelectron spectroscopy during growth (see section 8.1 on page 99) and laterally resolved NEXAFS (see section 8.2 on page 103). The orientation of the PTCDA molecules has been determined by linear dichroism to be flat lying on the Ag(1 1 1) surface in both, the bi-layer at the interface and in the 3D islands (see figure 8.5 on page 107). Astonishingly we found XNCD (x-ray natural circular dichroism), which is unexpected from the symmetry of the planar PTCDA molecule and have associated it to the 3D-crystallites (see figure 8.6 on page 111).