Summary

Low temperature STM, room temperature STM and HAS investigations of the Ga(010) surface have been performed within this work. Here the surface has been imaged for the first time in the low temperature phase with scanning tunneling microscopy (*see Fig.16, page 68*) and the unit cell was determined in detail (*see Fig.53 and Fig.54, page 100*). The presence of a charge density wave is not expected apriori on the Ga(010) surface, but was identified unambiguously with tunneling spectroscopy (*see Fig.29, page 81 and Fig.30, page 82*). Surprisingly two domains form well ordered parallel stripes (*see Fig.12, page 64*). With the normal imaging mode the atomically resolved structure of the room temperature phase of Ga was imaged for the first time in the present work (*see Fig.48, page 97*). An extensive helium atom scattering study complements the investigation of the Ga(010) surface.

Next to surface measurements the instrumental setup and thorough optimization of a STM for the operation at room temperature was a major part of the present work. Both low-frequency and high-frequency noise sources were effectively reduced with an optimized Besocke-beetle scanner setup built up during this work. The Besocke-beetle STM scanner setup was optimized for the operation at room temperature by using a new type of the piezoelectric elements – shear stack piezoelectric elements (*see Fig.1 and 2, page 26 and Fig.5, page 29*). This resulted in very high resonance frequencies and overall stability - the resonance amplitudes were improved by more than one order of magnitude as compared to commonly used tube piezos. This scanner was then implemented in a home designed UHV system, the setup of this UHV system was also part of the present work (*see Fig.4, page 27*).

The attempt to perform controlled manipulation of C_5H_5 radicals on a Ag(111) surface at room temperature was made within this work (*see Fig.14, page 51*). The room temperature STM measurements revealed a remarkable row-like arrangement of the C_5H_5 radicals as a result of radical-radical interaction (*see Fig.9, page 47*). Detailed images revealed an appearance resulting from a localized conductivity in the molecule and the adsorption geometry. Here calculations assisted the clarification of the imaging mechanism (*see Fig.8, page 45*). Additionally manipulation experiments of the C_5H_5 radicals showed a stronger bond to the Ag(111) surface than on the Ag(001) surface.