A high temperature scanning tunneling microscope (STM) capable of imaging during MBE-growth is described. We studied the epitaxial growth of Germanium on Silicon at 600 - 900 K sample temperature “in situ”. This technique gives access to the dynamics of the growth process on an atomic scale. The potential of the method is demonstrated by the following results:

The layer-by-layer growth of the two-dimensional Stranski-Krastanov layer of Ge on Si(111) and the formation of three-dimensional islands during further growth of Ge was observed. An inversion of the aspect ratio of the islands with increasing coverage indicates a transition from coherent to dislocated islands.

The transition from initial multilayer to pure layer-by-layer growth was imaged in Si(lll) homoepitaxy.

In Si(111) homoepitaxy growth was observed along stripes of the width of a (7x7) unit cell. Upon coalescence of islands new growth facets with different growth speeds are observed.

Some of the results will be presented on videotape. This method (MBSTM) opens the possibility to follow MBE growth processes dynamically on a nanometer scale and gives access to the evolution of specific features during growth.

The formation of striations as a result of modification of growth steps during the bunching and blocking of dislocation steps was detected by absorption microscopy. The spatial distance of the neighboring facets was measured as a function of time. An interpretation is given to this phenomenon based on our experimental observations.

Crystallization studies were carried out on monodisperse ultra-long chain n-alkanes which were shown to form chain-folded structures [1]. One of the most intriguing observations is the occurrence of a minimum in crystal growth rate as a function of temperature which was found for C_{19}H_{39}S, C_{24}H_{49}S and C_{29}H_{59}S. This effect was observed for solution crystallisation as well as for crystallisation from the melt. Real-time small angle X-ray (SAXS) experiments revealed a transition between an extended-chain and folded-chain crystallisation at the temperature where the minimum occurred.

The “self-poisoning” mechanism was proposed as an explanation of the observed retardation in crystallisation rate with increasing supercooling. According to this model, folded chain depositions occur more frequently than extended-chain ones and block the growing face of a polymer crystal.

Isothermal DSC melt-crystallisation studies of C_{24}H_{49}S and C_{29}H_{59}S will be presented, together with the results of combined real-time synchrotron SAXS/WAXS experiments.