The 2D heterogeneous nucleation assisted by the defects and the successive stages of layer-by-layer growth of a facet(111) surface on which emerged the outcrops of a dipole of screw dislocation, a piece of stacking fault [1], an A-Type twin lamella (re-entrant corner growth) [2,3], and a B-type twin lamella (rough stripe growth) [4,5] have been studied in an unified manner [6]. The influences of supersaturation, bond energy, growth temperature and characteristic parameters of the defects upon the growth kinetics and surface morphology for different defect mechanisms have been compared [7].

Reference:

Considerable increase in the rate of crystal growth from solution without reduction in crystal quality is possible using high levels of supersaturation. s. Growth of KDP and ADP crystal faces at supersaturations of up to 17% was investigated. Dislocation hillocks remain on the faces even at the maximum s, but at s > 8-10%, 2-dimensional nuclei are generated on the terraces between steps. Their generation is followed by a reduction in hillock slope. The shape of hillocks on the prism and bipyramid faces has been described. Use of atomic force microscopy made it possible to image hollow channels surrounding dislocation sources with Burgisser's vectors larger than one unit step. Because the dislocation spiral has to by-pass these channels, their presence lowers the step density. in the vicinal surface, the critical temperature of mode transition between 2D nucleation and step flow should increase.

Based on this model, the mode transition temperature was measured by changing group V to III flux ratio. It was found that the transition temperature decreases as the group V flux is increased [2]. This is explained in terms of the change of supersaturation at the step edge.


Real-time non-intrusive optical monitoring of the reproducibility of initial surface conditioning and the kinetics of nucleation and growth in chemical vapor deposition (CVD) processes is important for both the development of closed-loop feedback control and progress in the fundamental understanding of CVD. Recently, we have shown that the combination of p-polarized reflectance (PR), laser light scattering (LLS) and reflectance difference spectroscopy (RDS) is ideally suited for this task under low pressure conditions, where the ambient is represented by a dielectric constant close to one. The accommodation of these techniques to elevated pressures and high flow rates is desirable in the context of controlling point defect chemistry related optical and electrical properties of compound heterostructures presents a challenge because temporal and spatial variations in the dielectric function of the ambient phase degrade their accuracy. In this paper we briefly review the methods of optical monitoring of CVD processes that have been applied thus far in conventional regimes of pressure and flow and assess their potential under conditions of high pressure growth. This includes a critical evaluation of design criteria for the implementation of optical process monitoring under the conditions of high pressure vapor transport (HPVT) and of migration enhanced CVD processes at elevated pressure. Also, we compare optical real-time process monitoring to complementary methods, such as, mass spectrometric sampling. The results of finite difference computations for specific designs of HPVT and CVD reactors are presented and related to the monitoring and control of the growth kinetics. The paper concludes with an outlook at applications of real-time optical process monitoring in condensed phases.