

crystal occurs mainly due to the expansion of elementary layers of growth. They are 8.8 Å units high, which is equivalent to parameter a of a unit cell, and given the peculiarities of the specific structure, is also equivalent to one of the sizes of $C_{10}H_{10}N_2O_4$ molecule.

The statistical data processing reveals considerable differences in tangential dissolution rate on the two spirals, consisting of nine and four screw dislocations correspondingly. Right-screwing growth layers of the left spiral join, at some distance, the left-screwing steps of the right spiral, forming an even more complex source – a growth analogy of dislocational Frank-Read source. To calculate the tangential rates for such source, each image was overlaid by a special grid affixed to defined points – canals of dislocations. Then the position data of intersection points of grid meridian and the step contour were taken. Each two images required more than a thousand of coordinate readings. Then we schemed the step rate distribution for every image pair. The distribution came out to be bimodal, which required segregation of the results for the left and the right spirals. Each distribution was then approximated to the lognormal distribution, average tangential rates were determined as expectation value, and rate fluctuations were calculated as a mean-square deviation. The results show that for the left source steps the average tangential rate is two times greater than that for the right source ones throughout the whole experiment. On the whole, the tangential rate decreases towards the end of the experiment. The rate fluctuations for the steps of both groups also reveal an almost monotonous decrease. This means that the system is working towards equilibrium. The amount of substance in the solution is increasing and dissolution is going to give place to equilibrium. This brings forward an important inference: the left and the right part of the same growth source, located at a less than a micrometer distance from each other, have a different effect on the boundary layer of the solution. We have shown that the interface needs to have the horizontal concentration gradient of the substance which would provide a faster tangential rate of the left spiral at growth and a more active decrease at dissolution. The same assumption has been verified for bigger (100 mkm) hillocks.

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Keywords: AFM, crystal, growth.

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In situ observation of stress and strain evolution during surfactant-mediated growth of Ge on Si

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Interplay of surface stress and surface free energy determines the growth mode of heteroepitaxial layers. Therefore, surface morphology is sensitive to the presence of a third species on the surface, so-called surfactant. For instance, it is well known that the Stranski-Krastanow (SK) growth mode of Ge on Si can be suppressed with the surfactant. In such a surfactant-mediated epitaxy (SME), a flat Ge layer grows on Si while the surfactant floats up to the growth front and always covers the Ge surface. The stress in the Ge layer is relaxed by injection of dislocations into the Ge/Si interface.

Recently, Bi has attracted a lot of attention as a surfactant in Ge/Si(111) heteroepitaxy due to its ability to suppress Ge-Si intermixing and provide a chemical contrast between Ge and Si in a Scanning Tunneling Microscope (STM), allowing fabrication of self-organized

Ge/Si(111) nanostructures on the Si surface during STM measurement. In addition, low incorporation of Bi in the Ge layer allows to remove it from the flat Ge surface even after Bi-mediated growth.

We have focused on the stress and strain evolution during the initial stages of Bi adsorption on Si(111) 7x7 and Bi-mediated growth of Ge on Si(111). The stress and strain behavior and surface morphology were observed simultaneously by using real-time measurements of the substrate curvature and Reflection High Energy Electron Diffraction (RHEED). We find a clear difference in the surface stress between the clean Si(111) 7x7 surface and the Si(111) $\sqrt{3}\times\sqrt{3}$ surface covered with one monolayer of Bi (1 ML = 7.8×10^{14} atoms/cm²). Subsequent Ge deposition on Bi-adsorbed Si surface provides an increase in compress surface stress accompanied by simultaneous stress and strain oscillations. The compress stress is followed by clear stress relaxation at the critical coverage of 2 bilayers (1 BL = 2 ML) due to a variety of strain relief mechanism including injected misfit dislocation and increasing surface roughness on the Ge surface.

Keywords: epitaxy, heterostructure, stress

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Hydrothermal Synthesis of New $Er_xNi_xZn_{1-2x}O$ Nanomaterials and Their Physical Properties

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Zinc oxide (ZnO) is a wide-gap semiconductor, which is transparent from the visible to infrared regions and is resistant to reductive ambient. Because of these properties, it is expected to be applicable as a material for transparent electrode and window layers of solar cells. Among the different methods of synthesis of ZnO nanostructures, the hydrothermal method is attractive for its simplicity and environment friendly conditions. In this research, New $Er_xNi_xZn_{1-2x}O$ based nanomaterials were prepared by hydrothermal method. $Zn(NO_3)_2\cdot 6H_2O$ ($x \ll 1$ mmol) and NaOH (0.6 g) were added to distilled water (60 mL), and stirred well for 20 min at room temperature. Afterwards, Ni ($NO_3)_2\cdot 6H_2O$ and Er_2O_3 with various stoichiometric ratio were added, and the mixture was transferred to a 100 mL Teflonlined autoclave. The autoclave was sealed, maintained at 180 °C for 48 h, and then cooled to room temperature. The white precipitate obtained was filtered and washed with ethanol and water. Powder XRD patterns indicate that the $Er_xNi_xZn_{1-2x}O$ crystals ($x = 0.00-0.04$) are isostructural with ZnO. SEM images show that co-doping of Er^{3+} and Ni^{2+} ions in the lattice of ZnO results in different nanorods and nanoparticle morphology. UV-Vis absorption and emission spectroscopy reveals mainly d-d electronic transitions of the Ni^{2+} ions in case of nanomaterials.

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A Novel Three Dimensional Framework Induced by $\pi\cdots\pi$ Stacking of 2,2'-(alkylene-1,6-diyl)diisoquinolinium from Q[6]-based Pseudorotaxane

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