SFB 608

Einladung zum Kolloquium

Ort: Universität zu Köln
II. Physikalisches Institut, Seminarraum 201

Zeit: Mittwoch, 09.02.05, 14 Uhr c.t.

Sprecher: Prof. Thomas Michely
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Thema: The kinetics of stacking fault formation in thin film growth

Stacking fault formation during growth far from equilibrium may occur on the dense packed fcc or hcp surfaces, which supply regular and faulted adsorption sites. In homoepitaxy on Ir(111) stacking fault islands are readily identified with scanning tunneling microscopy (STM) by their distinct island shape, allowing to study the kinetics of their formation. Based on the analysis of the temperature and flux dependence of the fault island nucleation probability an atomistic model is developed: At a given temperature the distribution of large metastable fault islands represents the Boltzmann distribution of those small mobile clusters over regular and faulted sites, which are immobilized by addition of an adatom. Using field ion microscopy data as an input for rate equations allows to quantitatively reproduce the experiments.
Insight into the dependence of the fault formation probability on cluster mobility and fault energy on dense packed fcc and hcp surfaces is gained by constructing a model system on the basis of the available experimental data. A rate equation investigation of its behaviour shows that low cluster mobility and low stacking fault energy are equally important factors in favouring fault formation.
Once faulted and regular film areas are formed, partial self-healing of the faulted surface phase may take place through an assimilation process upon encounter of areas of different stacking. Despite the partial self-healing, occasionally decoration rows form, which stabilize faulted areas. During multilayer growth these defects cause the formation of a thin film with a random mixture of twinned and untwinned crystallites. By use of low energy electron diffraction it is found that such randomly twinned films are highly stable against thermal healing. Based on these observations, strategies for avoiding stacking fault formation due to kinetic reasons in thin film growth are discussed.

Gez. Prof. Krug & Prof. H. Tjeng