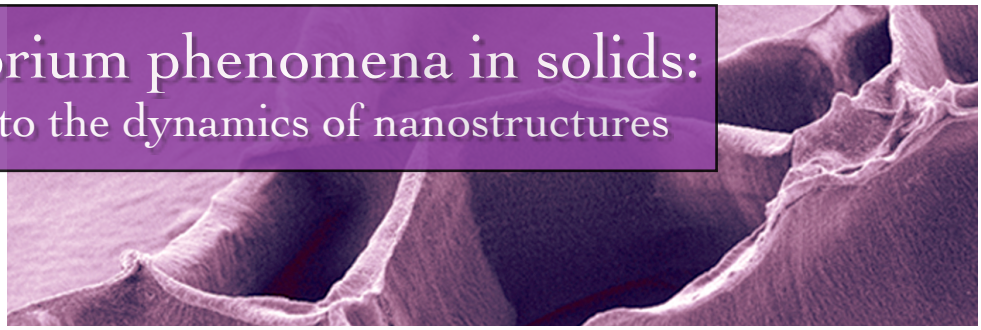
First Latin American SCAT Summer School

Universidad Técnica Federico Santa María, Valparaíso

Nonequilibrium phenomena in solids:
Applications to the dynamics of nanostructures



One of a series of mini-courses taking place 6-12 January 2007

Description

The aim of this mini-course is to provide a brief account of the physical processes involved in the formation of nanostructures on the surface of a growing crystal. It focuses on the construction of models starting at the atomic level, where physical processes are dominated by the kinetics and the elasticity of adsorbed atoms, and reaching the macroscopic level, dominated by growth instabilities and nonlinear effects, to describe the surface evolution. As a specific example we consider the epitaxial growth of semi-conductor materials (silicon and germanium Si/Ge) to study the stability of the step flow (bunching and meandering) and the stability of a strained solid film (coupling between mass transport and elasticity).

Contents

- Basic models of epitaxial growth — The crystal surface, surface energy and chemical potential. Singular and rough surfaces. Phenomenological equations of surface growth.
- Kinetics of adsorbed atoms — The vicinal surface: steps, terraces and surface reconstruction. Diffusion of adatoms, kinetics of the attachment, the Schwoebel effect. The Burton, Cabrera and Frank model.
- Stability of the step flow — Nonlinear models of the step flow instabilities, bunching and meandering; derivation of the evolution equations of the surface homoepitaxial growth. Analytical and numerical methods.
- Elasticity of steps and solid films — Elastic field created by the misfit between the substrate lattice and the deposited film. The Grinfeld instability. Steps interactions. Numerical models. The nonlinear evolution of a strained film. The kinetic roughening transition, stochastic effects.

Lecturer:

Dr Alberto Verga, Institut de Recherche sur Phénomènes Hors Equilibre
Université de Provence

This course can be offered either in English or Spanish. The organizers will decide according to the needs of the local participants, and it will be announced soon.

For more information, email
info@scat-alfa.eu or visit www.scat-alfa.eu

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