UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Theory and modelling of epitaxy

2223-116R-M1

Title

Theory and modelling of epitaxy

Teacher(s)

Dr. Roberto Bergamaschini

Language

English

Short description

The course provides a general introduction to the physics of epitaxial growth, offering an overview of the key thermodynamic and kinetic factors driving the formation of thin-films rather than three-dimensional micro- or nano-structures during material deposition.
The topics will include:

1. General concepts of epitaxy and experiments
2. Growth methods

- physics of crystal growth
- review of key experimental growth methods: LPE, MBE, CVD, ALD
- characterization techniques: STM/AFM, LEED, RHEED

3. Surface energy and crystal shape
4. Continuum models of morphological evolution

- Mullins model: thermal smoothing
- kinetic effects and Kinetic Wulff shape - The Asaro-Tiller-Grinfeld instability and beyond

5. Nucleation theory and island growth
6. Atomistic growth mechanisms

- Solid-on-solid model and concept of KMC
- step kinetics model
- Erlich-Schwoebel barrier and step bunchings

7. Plastic relaxation in epitaxy

- dislocations, types and properties - dislocations in films and critical thickness
- dislocated islands

8. Self assembly and nanostructures: QD, QW, NW

- ordering and substrate patterning
- top-down approach: selective area growth
- droplet epitaxy
- the vapour-liquid-solid (VLS) growth mode and Nanowires
- core-shell structures

CFU / Hours

2 CFU / 16 hours

Teaching period

February

Sustainable Development Goals

QUALITY EDUCATION