Semiconductor Crystal Engineering

Prof. Shiro Tsukamoto, National Institute of Technology, Anan College (Giappone)
16 h (2 cfu)

1. Introduction to semiconductor crystal engineering.
2. Historical backgrounds and general characteristics of semiconductor.
3. General crystal growth methods.
4. Molecular beam epitaxy.
5. General observing methods for crystal growth surface.
6. Scanning tunneling microscope.
7. General applications for industrial needs.
8. Quantum dots.

Supramolecular and Macromolecular Chemistry: synthesis, structure and functions

Prof. Angiolina Comotti, Università di Milano-Bicocca
8 h (1 cfu)

1. Crystal Engineering
2. Intermolecular interactions: general properties and self-assembly
3. Design strategies for building crystals, polymorphism and multicomponent compounds
4. Crystallinity in Polymers
5. Methods of study and analysis of supramolecular assemblies
6. Dynamics in the solid state
7. New methods for the fabrication of porous structures: covalent frameworks, molecular crystals and coordination polymers
8. Properties and Applications: gas storage, purification of gas mixtures, molecular rotors and motors

Prof. Roberto Simonutti, Università di Milano-Bicocca
8 h (1 cfu)
1. Polymer nanostructures: micelles, vesicles, bottlebrushes, core shell nanoparticles.
1.1. Fabrication and characterization
1.2. Applications in nanomedicine
1.3. Self Healing Materials

2. Functional Hybrid Materials
2.1. Self assembly of inorganic nanoparticles within block polymers micelles
2.2. 2D nanostructures via self assembly of thin films
2.3. Applications in catalysis, optics and electronics

3. Polymer Brushes on Macroscopic surfaces
3.1. Synthesis and characterization
3.2. Responsive surfaces
3.3. Non biofuling surfaces
3.3. Cell adhesive surfaces

Two-dimensional Crystals: Properties, Synthesis, and Applications

Dr. Alessandro Molle (CNR-MDM)

8 h (1 cfu)

1. Introduction of two-dimensional crystals
2. The case of graphene: basic physics and applications
3. Beyond graphene: monoelemental Xenes
4. Transition metal dichalcogenides; synthesis and applications
5. Lego-like materials: van der Waal heterostructures

Principles and applications of nano-biotechnologies

R. Grandori/M. Colombo/ F. Gelain/ D. Prosperi, Università di Milano-Bicocca

8 ore (1 cfu)

1. Synthesis and biofunctionalization of colloidal nanoparticles.
2. Non-covalent interactions of proteins with nanoparticles.
3. Nanostructured biomaterials for tissue regeneration.
4. Protein-DNA interaction at single molecule level.
5. Biomedical application of colloidal and biomimetic nanoparticles.

Interactions between light and materials: some examples and applications

Prof. Christophe Dujardin, Unité de Catalyse et Chimie du Solide, Université de Lille 1
8hrs – 1cfu

-1-General properties of optical materials

-2-Luminescence from matter used as thermal probe

-3-Excitation under ionizing radiation: Scintillators and Applications

-4-Excitation under ionizing radiation: Scintillators and Processes

-5-Index of refraction in the case of emitting nanoparticles

-6-Single particle spectroscopy: Blinking properties of nano particles

-7-Nanoscintillators: Interest and subtleties

-8-Pulsed laser ablation in Liquid and Laser induced breakdown spectroscopy

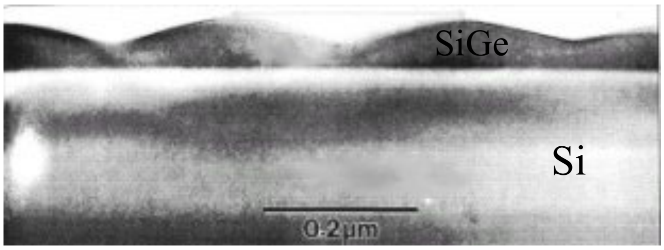
ELASTICITY AND INSTABILITY:
APPLICATION TO METALLIC AND HYPERELASTIC STRUCTURES

J. Colin
Institut P', Université de Poitiers, ENSMA, SP2MI-Téléport 2, F86962 Futuroscope-Chasseneuil cedex, France.

Nowadays, the theory of elasticity appears to be a powerful tool to investigate the mechanical behavior of a wide range of materials, from metallic to soft or hyperelastic solids. The purpose of these lectures is to discuss a series of problems from different fields of research such as materials science, surface physics, engineering or solid mechanics, where the elastic properties of the materials play a key role in determining the critical parameters responsible for various shape instabilities.

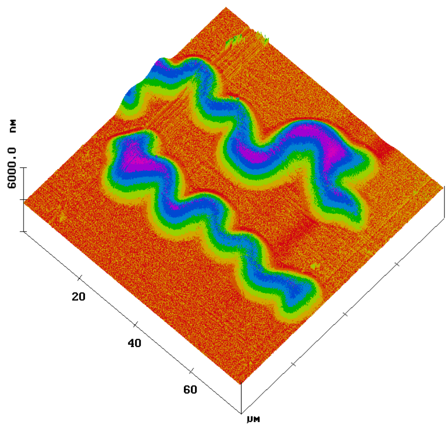
After a short presentation of the fundamental equations of the elasticity theory and the introduction of several techniques of resolution (Airy function, Green function, Boussinesq force, etc.), different problems will be considered at different length scales:

1 morphological evolution of metallic solids or semi-conductors under stress, Introduction of the so-called "Grinfeld" instability and presentation of relating problems in materials science, nano-electronics and engineering.



(Gao et al.)

2. delamination and buckling of thin films on substrates, coatings and multilayered structures. Application to mechanical engineering, geology and materials science.



(Coupeau et al.)

3. wrinkling of soft hyperelastic solids. Application to rubber, elastomer and biological tissue instabilities.