

Micro and Nanotechnology: Integration and Packaging

ECTS	Course (h)
3	18

Mention du master transmettant la fiche UE :	Chimie et Sciences des Matériaux
Composante de gestion de l'UE :	Faculté des Sciences – Département de Chimie
Responsable de l'UE :	Christian BRYLINSKI
Statut du responsable :	PR

REQUIREMENTS

General background on the structure and physical properties of inorganic and organic materials (e.g. metals, alloys, ceramics, semiconductors, polymers, composites, ...)

PROGRAM

This series of lectures is an introduction to the world of micro and nanotechnology and the related packaging. A specific emphasis is put on the material issues related to each individual technology brick and to the global integration of these bricks into an efficient micro or nanodevice fabrication process, including the final interconnection and packaging. An overview on the influence of the ubiquitous pervasion of micro and nanotechnology on society and environment is proposed.

The overall program is divided into six main chapters:

- 1 - Introduction to the current applications of micro and nanotechnology: information storage, computing, transport, imaging, display, photovoltaic, lighting, electric energy control and distribution.
- 2 - Introduction to the main evolution trends in the world of micro and nanotechnology: size reduction, multi-functional and heterogeneous integration, with a special focus on the key example of CMOS VLSI technology: Moore's law and its eventual spin offs "More Moore", "More than Moore".
- 2 - Particular focus on the key role of substrate materials and wafering: issues around cutting, grinding, polishing, cleaning, and the influence of material micro-structure on these operations.
- 3 - Presentation of the main key technology bricks and materials involved in micro and nanofabrication: thin film growth, stacking issues, etching techniques.
- 4 - Panorama of the lithography principles and main techniques: direct writing, UV, electron beam, stepper, micro and nano imprint with an emphasis on the multiple material related issues.
- 5 - A progressive insight on fabrication process steps integration and sequencing strategies, illustrated on three device examples of increasing complexity.
- 6 - A view on the device connecting and packaging technology, and the related material issues: electrical, thermal, chemical, in connection with the necessary reliability and robustness of the final product in operational environment.

SPECIFIC SKILLS

- Main applications of micro and nanotechnology
- Main evolution trends in micro and nanotechnology: Moore's law and further evolution
- Main substrates materials
- Main wafering and shaping techniques
- Main micro and nanotechnology bricks
- Lithography
- Process steps integration and sequencing strategies
- Connecting and packaging technology for Micro Nano Systems