Labex INTERACTFS (https://labex-interactifs.pprime.fr/)

2022 Projet Proposition d'un module de cours à destination des doctorants

I. Informations générales :

Etablissement d'accueil ***Institution***	**X UP** ☐**ENSMA**
TITRE du cours en français ***French title***	**LES INTERFACES DANS LES FILMS MINCES NANOMETRIQUES: CONSÉQUENCES SUR LA** **CROISSANCE, LA STABILITÉ ET LES FONCTIONNALITÉS**
TITRE du cours en anglais ***English title***	**INTERFACIAL PHENOMENA IN NANOSCALE THIN FILMS: IMPLICATION ON GROWTH,** **STABILITY AND FUNCTIONALITY**
Enseignant ***Teacher***	Grégory ABADIAS **Tel :** 05 49 49 67 48 **Email :** gregory.abadias@univ-poitiers.fr

Jours	Horaire	Salle

II. Brève description du cours proposé

Framework

Surfaces and interfaces are key attributes in nanoscale thin films due to the large surface-to-volume ratio. Examples include nanoparticles (for catalysis and plasmonic applications), nanometric multilayers and superlattices or nanocomposite films with enhanced mechanical properties or tolerance to radiation damage, porous layers for superior hydrogen storage. Surfaces/interfaces play decisive role in adsorption, surface diffusion, in governing the equilibrium shape and faceting of crystals, wettability in solid/liquid systems, the stress state in polycrystalline films, or during ageing or thermal treatment (grain growth, stress relaxation, dewetting).

This lecture is intended to a large audience, and particularly to PhD students involved with thin films, and surface functionalization. It will provide fundamental concepts on surfaces and interfaces, from thermodynamic point of view as well as kinetic considerations. Selected examples will be taken from state-of-art literature in the related field, including the instructor's own research data and covering both experimental and computational modelling studies. The core content of this lecture is directly in line with the topics 1 and 2 of the LABEX INTERACTIF, more specifically

- Physical vapor deposition

- Surface structuration and patterning using ion beam/laser techniques
- Adhesion and mechanical integrity (stress state)

The instructor is working in the field of nanoscale thin films for more than 20 years. He is also regularly teaching a short course on “stress evolution during thin film growth” at international conferences (EMRS, ICMCTF), so there will be no difficulty to propose this lecture in English.

Course objectives and content (10h)

- Adsorption, surface reconstruction and self-organization
- Surface energy, surface stress
- Equilibrium morphology and faceting of nano-objects
- Wettability, contact angle measurements and surface texturing (laser, ion beam)
- Early stages of thin film growth: from nucleation, coalescence to formation of a continuous layer
- Stress evolution during thin film growth (including *in situ* characterization)
- Solid state dewetting phenomena
- Functionality of nanoparticles and nanoscale thin film