MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année

Spécialité Sciences des Matériaux et Nano-objets

UPMC Paris 6, ENS, ENS Cachan, ENSCP, ESPCI et l'École Polytechnique

Proposition de stage 2009-2010

Laboratoire: Unité mixte CNRS/Saint-Gobain **Laboratoire Surface du Verre et Interfaces (SVI)** **Adresse: 39 quai lucien lefranc 93303, Aubervilliers** **Directeur du laboratoire: Elin Søndergård**	
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Mechanics of functional thin films

Projet scientifique :

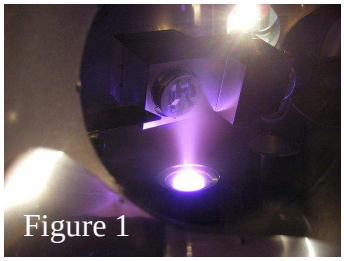
Figure 1

Thin films and their stacks are used in all kind of industrial applications. Examples scatter from epitaxial 3D-strucutres in semiconductor industry, to hard and resistive coatings, to optically active stacks as X-ray, UV and visible light mirrors. Sputter-deposition (see figure 1) appeared to be exceptionally popular in industry due to its high deposition rates and wide range of parameters allowing for properties control. Intrinsic stresses (volume forces) in thin films produced by this technique are practically unavoidable due to the non-equilibrium nature of the deposition process.

Although unavoidable, knowledge of the causes of intrinsic stresses gives a unique ability to adjust them for a purpose. For example, stresses can be adjusted to be highly compressive in order to observe the limit for the stack's integrity, i.e. the interfacial toughness. In case a film or an interface fails under the load of stresses, a blister is often formed shown in figure 2. The blister sizes are driven by several phenomena: the stress, the interfacial strength, the elasticity and plasticity of the parts and the geometrical parameters. By considering these entities in a model, we were able to perform comparative studies of adhesion and on the relation between the stress and the blister dimensions.

In this project, we aim for a quantitative modelling of the mechanics of the blister formation and propagation combined with experimentation. A specifically designed high vacuum chamber will be used for deposition of films and stacks with thickness gradients. The in-situ in real time stress measurement will provide control over this parameter. The blisters will be then characterized by an optical profilometer. The modelling is to be done with the help of our academic collaborators.

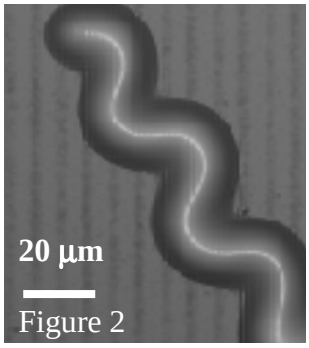

Figure 2

Techniques utilisées :

Vacuum equipment, sputter-deposition, in-situ stress measurements, optical profilometry, microscopy.

Qualités du candidat requises :

The candidate must have a strong affinity for experimentation. In addition, a solid background in general physics and in solid state physics is the must.

Rémunération éventuelle du stage : 800€ brut environ

Possibilité de poursuivre en thèse : Oui

Si oui, quel est le mode de financement envisagé : Financement CIFRE