PhD Thesis subject

Physical properties of functional thin films under mechanical stresses

Université de Poitiers / synchrotron SOLEIL, France

Scientific context and project

The proposed thesis is part of an international collaborative research project (PRCI) of the ANR (French National Research Agency) and its Austrian alter ego the FWF (Fund zur Furderung der Wissenschaftlichen Forschung). This project, whose leaders are M.J. Cordill (ESI-Austria) and D. Faurie (LSPM-CNRS, France) is called NANOARCHITECTED FILMS FOR UNBREAKABLE FLEXIBLE ELECTRONICS (NANOFILM).

Stretchable microelectronics devices are developing more and more in many application sectors and in particular in biology and medicine using human tissues. In bio-inspired systems, the thin functional layers are deposited on flexible substrates and one of the major stakes is related to the mechanical behavior of the composite material both during synthetization and also during operation.

Our group in Poitiers (France) has been developing studies on the mechanical behavior of such systems for more than a decade, playing on the mechanical contrast and size effect of the thin films and substrates used. We master perfectly within the Pprime Institute at the university of Poitiers the synthesis by ion sputtering of thin and multilayer films (size effect and interface) on polymer substrates.
In this context, the thesis aims to understand the relationship between the microstructure and the mechanical and electrical properties of nanostructured thin films.

The contribution of synchrotron radiation will be crucial to study in situ during deformation the structural and microstructural characteristics of the films, their mechanical behavior and their electrical property (see Figure 1). X-ray diffraction will be the main technique used and will be supported by electrical characterization techniques such as Hall effect and Van der Pauw resistivity. The candidate will have the opportunity to participate in the design and production of a new biaxial traction machine of smaller dimensions than the one used in diffraction (Fig. 1) to visualize cracks under atomic force microscopy (AFM).

Access to the SOLEIL synchrotron will be within the competitive framework of the submission of projects to the ad hoc program committees.

Main skills developed during PhD

- ability to use multiphysical analysis techniques on material science: optical and electronic characterization, X-ray diffraction, atomic force microscopy (AFM);
- knowledge of synchrotron radiation potentialities ;
- ability to manage and to analyze all the data (especially diffraction data analyses)
- ability to be autonomous and conduct research in close collaboration with program members

- ability to produce clear, concise and accurate reports
-participation to the development of biaxial tensile tester.

Funding : about 1500 euros net / month.

Specificities of the job : The recruitment is done by the University of Poitiers. But the job will be mainly performed at the university of Poitiers (86, Futuroscope-Chasseneuil)) and partly at the university Sorbonne-Paris Nord (villetaneuse France) and also synchrotron SOLEIL (Gif-sur-Yvette). Selection will be made on the basis of academic merit. The successful candidate should have, or expect to have, a master degree (or equivalent) in Material Science, Applied Physics or related areas.

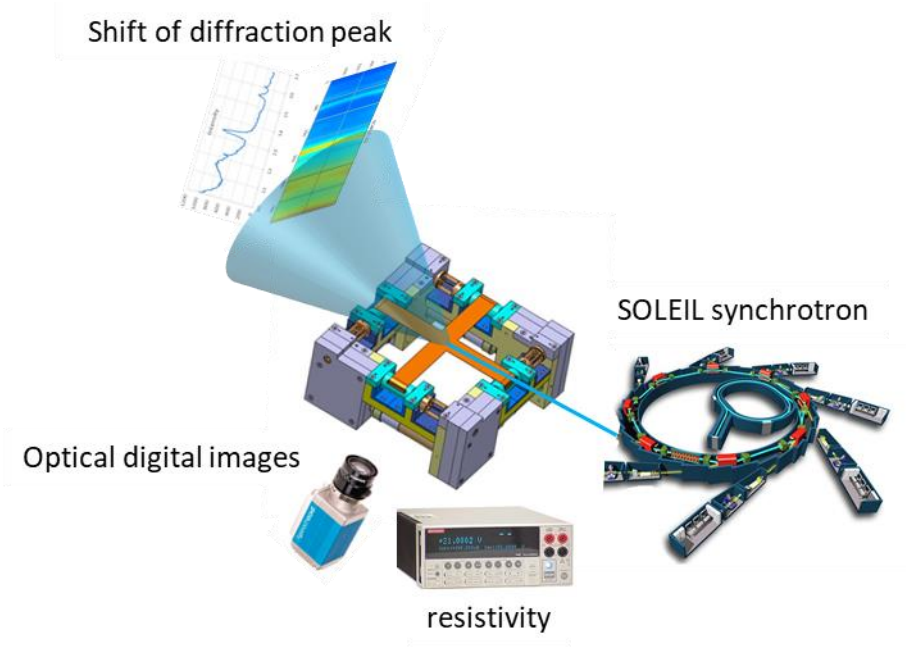

Figure 1: scheme of experimental set up that will be used during PhD : 2D x-ray detector, biaxial tensile tester, optical camera for digital image correlation technique, and resistivity measurements.

Application Management

Applications, consisting of a CV, notes of master 1 and 2, a letter of motivation and letter of recommendation, should be sent to

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