Combined refinement of GIXRF, XRR and XRD data in a global approach:

analysis of textured ITO/Ag/ITO/Si architectures and

III-V based heterostructures.

Magali Morales[(1)], L. Lutterotti [(2)], Daniel Chateigner[(2)], Bérenger Caby[(3)], Emmanuel Nolot[(3)], Patrice Gergaud[(3)], Giancarlo Pepponi[(4)]

[(1)] CIMAP – ENSICAEN, 6 boulevard du Maréchal Juin, 14050 Caen Cedex 4
[(2)] CRISMAT – ENSICAEN, 6 boulevard du Maréchal Juin, 14050 Caen Cedex 4
[(3)] CEA Grenoble – Leti – Minatec Campus, 17 rue des Martyrs, 38054 Grenoble Cedex 9
[(4)] Fondazione Bruno Kessler – Via S.Croce 77, 38122 Trento, Italie

There is a critical need for optoelectronic devices optimization to give quantitative chemical composition measurement of these materials with buried interfaces and with nanometer depth resolution. Grazing-incidence X-Ray Fluorescence (GIXRF) is a new technique that offers the potential to substantially provide high sensitivity to investigate surface or buried interface contamination as well as elemental depth-profiling capabilities. In combination with X-Ray Reflectometry (XRR), this method will also allow for depth resolved material characterization with resolution in the nanometer range. Moreover, as sometimes the polycrystalline studied films exhibiting also preferential orientations, these two techniques can be also coupled with X-Ray quantitative texture measurements (XRD).

For the first time, on transparent conducting oxides multilayered samples for photovoltaic applications, using the new developed combined GIXRF-XRR-XRD analysis approach (through the MAUD program) we have determined the different layer thicknesses and their crystallographic preferred orientations and we have evidenced the presence of a gradient profile for the chemical composition and for the films density.

This combined GIXRF-XRR-XRD analysis approach will be also tested for the characterization of single crystalline InGaN, AlGaN or InAlN layers or heterostructures.