



Experiment title:
GISAXS and GID study of magnetic tunneling junction structures based on doped ZnO ferromagnetic nanocrystals

Experiment number:
SI 1961

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| Beamline: ID 01 | Date of experiment: from: 16.12.2009 to: 21.12.2009 | Date of report: 28.02.2013 |
| Shifts: 15 | Local contact(s): Geraldina Carbone | <i>Received at ESRF:</i> |
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Report:

Zinc oxide (ZnO) is an attractive material for applications in electronics, optics, photonics, and ultraviolet and chemical gas sensing. [1, 2] Over the last decade, the special interest on ZnO has been caused by prediction and demonstration of ferromagnetism in ZnO based diluted magnetic semiconductors, when ZnO is doped with magnetic elements, such as Co, Mn, and Fe. [3] Nowadays, nanoscale materials have attracted considerable attention for their features and potential applications in various areas. From technical and technological points of view, it is important to grow NCs embedded in a matrix. Moreover, the implementation of ZnO NCs in spintronic applications requires long spin coherence times, which can be realized by embedding them in optical cavities.

During this experiment ZnO thin film (thickness of 1 - 100 nm) produced by pulsed laser deposition (PLD) on c-cut sapphire and Si(100) substrates in thin films laboratory at University of Minho were characterized by Grazing Incidence X-ray Diffraction (GIXRD). Note, that it was not possible to perform planned measurements of Grazing Incidence Small Angle X-ray Scattering (GISAXS) due to some technical reasons at the beamline.

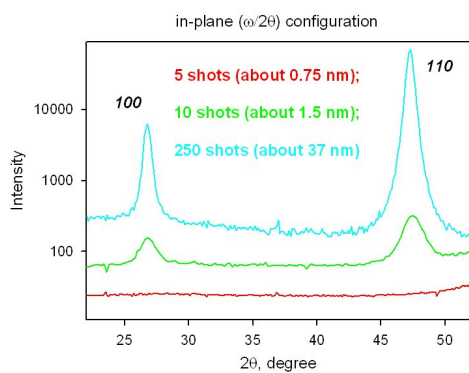


Fig. 1. GIXRD patterns of ZnO thin film with different thickness on sapphire substrate.

GIXRD study shows that all nanostructures produced at room temperature and without subsequent annealing were amorphous.

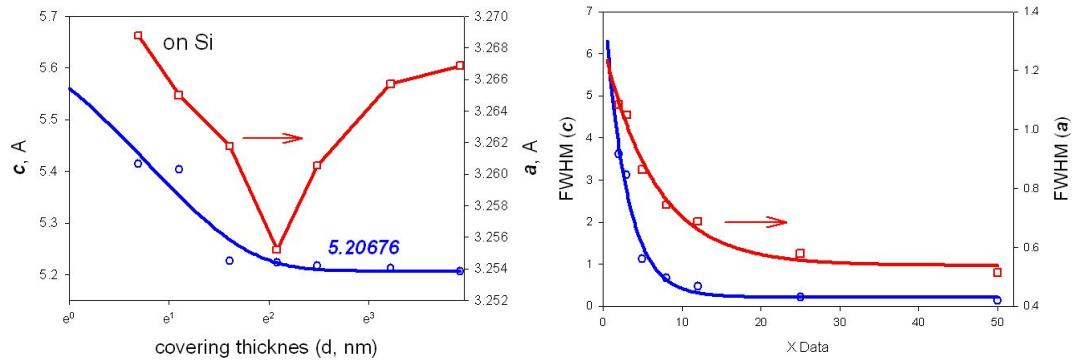


Fig. 2. Lattice parameter and FWHM of ZnO nanocrystals on Si substrate depending on deposited nominal thickness

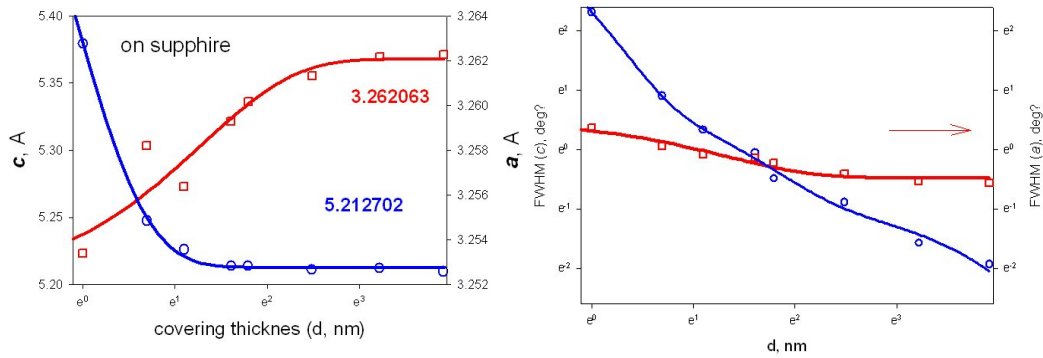


Fig. 3. Lattice parameter and FWHM of ZnO nanocrystals on c-cut sapphire substrate depending on deposited nominal thickness

References

- [1] L. Castaneda. Acta Mater. 57 (2009) 1385.
- [2] A. U. Ubale and V. P. Deshpande. J. Alloys Compd. 500 (2010) 138.
- [3] R. Lard, E. Talbot, P. Pareige, H. Bieber, G. Schmerber, S. Colis, V. Pierron-Bohnes, and A. Dinia. J. Am. Chem. Soc. 133 (2011) 1451.