MS25 O1

Simultaneous microRaman spectroscopy and X-ray microdiffraction Richard J. Davies, Manfred Burghammer, Christian Riekel. *European Synchrotron Radiation Facility, Grenoble, France.*
E-mail: rdavies@esrf.fr

Keywords: Raman spectroscopy, Microdiffraction

Raman spectroscopy and X-ray scattering are complementary techniques. Whilst one provides information relating to molecular bond energies and orientations, the other probes a sample's crystallographic structure and morphology. Thus, not only do they provide differing information, but this relates to quite different length scales within a materials' hierarchical structure. However, the two techniques also share several similarities. They are non-contact and non-destructive for many materials, and neither requires modified or coated samples. As a result, both are used extensively for in-situ studies such as investigating the effects of deformation, temperature or pressure, and are frequently reported together. Over recent years Raman spectroscopy and X-ray scattering have independently evolved microfocus capabilities. With smaller laser and X-ray beams, smaller structural heterogeneities can be resolved within an individual sample. Microfocussing also allows confined sample volumes to be studied and reduces averaging when performing in-situ experiments. However, microscopic sampling can be problematic for combinatorial studies. In particular, many materials are heterogeneous over such length scales. This makes it difficult to ensure that data collected sequentially is from the same point on the specimen. Meanwhile, for in-situ studies, it is very difficult to reproduce dynamic behaviour in sequential experiments. Many of these difficulties can be overcome by collecting both data sets simultaneously in-situ. This capability is available at the ID13 beamline of the ESRF. Its combined μRaman and μXRD setup delivers the laser and X-ray beams to the same point on the sample simultaneously using an on-axis geometry, [1]. At the common focal position both beams have a spot size of approximately 1 μm, [1]. This novel tool for materials' characterisation ensures a common sampling location on the specimen and consistency during dynamic studies. In addition, it also reduces experimental time, and is beneficial for rare and valuable samples. The system's specifications and capabilities have been demonstrated using laboratory-produced specimens, [1]. Meanwhile, its novel ability to access both the crystalline and amorphous fraction has already provided a new insight into structure-property relationships in high-performance fibres, [2].

[1] Davies R.J.; Burhammer M.; Riekel C., *Applied Physics Letters*, 2005, 26, 264105.
[2] Davies R.J.; Burhammer M.; Riekel C. *Macromolecules,* 2006, 39, 4834.

MS25 O2

Multiwavelenght Anomalous Diffraction (MAD) and Diffraction Anomalous Fine Structure (DAFS) in the study of structural properties of nanostructures H. Renevier[a], J. Coraux[b], M.G. Proietti[c], V. Favre-Nicolin[b], B. Daudin[b] *[a]Institut Polytechnique de Grenoble, Laboratoire des Matériaux et du Génie Physique, UMR5628 CNRS-INPG, INPG-MINATEC, 3 parvis L. Néel, 38016 Grenoble, France. [b]CEA Grenoble, DRFMC/SP2M 17 rue des Martyrs, 38054 Grenoble Cedex 9, France. [c]Departamento de Fisica de la Materia Condensada, Instituto de Ciencia de Materiales de Aragon, CSIC-Universidad de Zaragoza, calle Pedro Cerbuna 12, 50009 Zaragoza, Spain.*
E-mail: hubert.renevier@inpg.fr

Keywords: MAD, DAFS, nanostructures

The knowledge of strain, chemical composition, inter-mixing at the interfaces, are of great importance to understand the growth mechanism as well as the electronic and optical properties of hetero and nanostructures. Moreover, to be suitable for devices, the nanostructures are encapsulated or embedded in a superlattice and capping plays a decisive role in the modification of the optical properties by modifying the strain and possibly inducing atomic diffusion. Strain is closely related to composition, shape and aspect ratio of the nanostructures, and on the mutual stress which nanostructures, substrate and the matrix apply to each other. X-ray diffraction is known to be a powerful tool for measuring strain fields. The combination of MAD which allows to extract the scattering amplitude of the resonant atoms, and DAFS, which allows to determine the local environment of atoms located in an iso-strain volume selected by diffraction, is a very powerful approach to disentangle strain and compostion. A MAD or a DAFS experiment consists in recording the scattered intensity as a function of the incoming x-ray beam energy in the vicinity of absorption edges. Like X-ray Absorption Fine Structure (XAFS), DAFS provides information about the local environment of the resonant atom (also known as the anomalous atom). We will give a brief insight on the basic principles of the MAD and DAFS methods. Then we will report examples of *grazing incidence* MAD and *grazing incidence* DAFS studies of the structural properties of GaN Quantum Dots and InAs Quantum Wires (embedded or not) [1,2,3,4,5]. We will also give a comparison with glancing angle x-ray absorption (XAFS) studies and show the complementarity of XAFS and DAFS.

[1] A. Letoublon et *al*., Phys. Rev. Lett., 92, 2004, 186101.
[2] J. Coraux et *al*., Phys. Rev. B, 73, 2006, 205343.
[3] J. Coraux, et *al*., Phys. Rev. B, 74, 2006, 195302.
[4] J. Coraux et *al*., Phys. Rev. B, 75, 2007.
[5] J. Coraux et *al*., Appl. Phys. Lett., 88, 2006, 153125.

MS25 O3

RDF analysis, Positron Annihilation and Raman Spectroscopy of $xTiO_2$-(60-x) SiO_2-40Na_2O nonlinear Optical Glasses: III. Non-bridging oxygen bonds tracing and structural analysis A. Abou Shama[1], M.S. Abd El-Keriem[1], M. Abdel Baki[2], F. El-Diasty[1] *1 Physics Department, Faculty of Science, Ain Shams University, 11566 Abbassia, Cairo, Egypt 2 National Research Center, Glass Department, Dokky, Giza, Egypt.*
E-mail: shamaphysics2002@yahoo.com

Keywords: nonlinear optical properties, RDF analysis, Positron annihilation.

$xTiO_2$-(60-x)SiO_2-40Na_2O glasses have proven an interesting nonlinear optical properties [1]. The investigated glasses show one order of magnitude