	Experiment title: Semiconductor nanocrystall in glass by sequential ion-implantation procedure: an EXAFS study	**Experiment number**: 08-01-276
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Names and affiliations of applicants (* indicates experimentalists):

F. Gonella*, Physical Chemistry Dept., University of Venice, Italy

E. Cattaruzza*, INFM, Physical Chemistry Dept., University of Venice, Italy

F. D'Acapito*, GILDA CRG, ESRF, Grenoble, France

C. Maurizio*, Physics Dept., University of Padua, Italy

S. Padovani*, Physics Dept., University of Padua, Italy

Report:

The aim of this experiment was to determinate the local order around the species forming semiconductor quantum dots within silica matrix upon sequential ion implantation and successive different annealing treatments. Sequential double implant were performed in fused silica glass of In^+ and N^+, Zn^+ and Se^+, moreover a triple implant of As^+, Ga^+ and In^+ was performed. The implantation energies were chosen in order to maximize the overlap of the concentration depth-profiles of the species. In case of samples doped with In, the sequential double implantation of each ionic species allows to obtain a tenth-nm thick layer with homogeneous In and N concentration. Ion implanted slides were than heat-treated in different (nitrogen, hydrogen, air) atmosphere. X-ray absorption spectroscopy was performed at the In, As, Ga, Se and Zn K-edges, in order to determinate the local order around the dopant species within the silica matrix; due to the sample dilution (nanocrystals are confined in a surface layer about 100 nm thick), X-ray fluorescence yield detection was used. Figure 1 shows the moduli of Fourier transform of the samples containing In, compared with the spectra of In bulk and In_2O_3 powder, measured in transmission mode. Single implant of In^+ ions in silica glass promotes the formation of In clusters; the sequential N^+ implant destroys the cluster and promotes the formation of an In_2O_3 phase. The presence of In clusters is also evidenced after the annealing in nitrogen for the double implanted In^++N^+ sample. Figure 2 shows the moduli of Fourier transform of the As^++Ga^++In^+ implanted silica glass. As shown in figure 2, the observed interatomic distances are in agreement with the

in the double implanted sample; the annealing in reducing atmosphere promotes a partial reorder of the system, yet without changing the cluster structure. Instead, annealing in air promotes the separation of the species and the formation of ZnO and Se clusters.

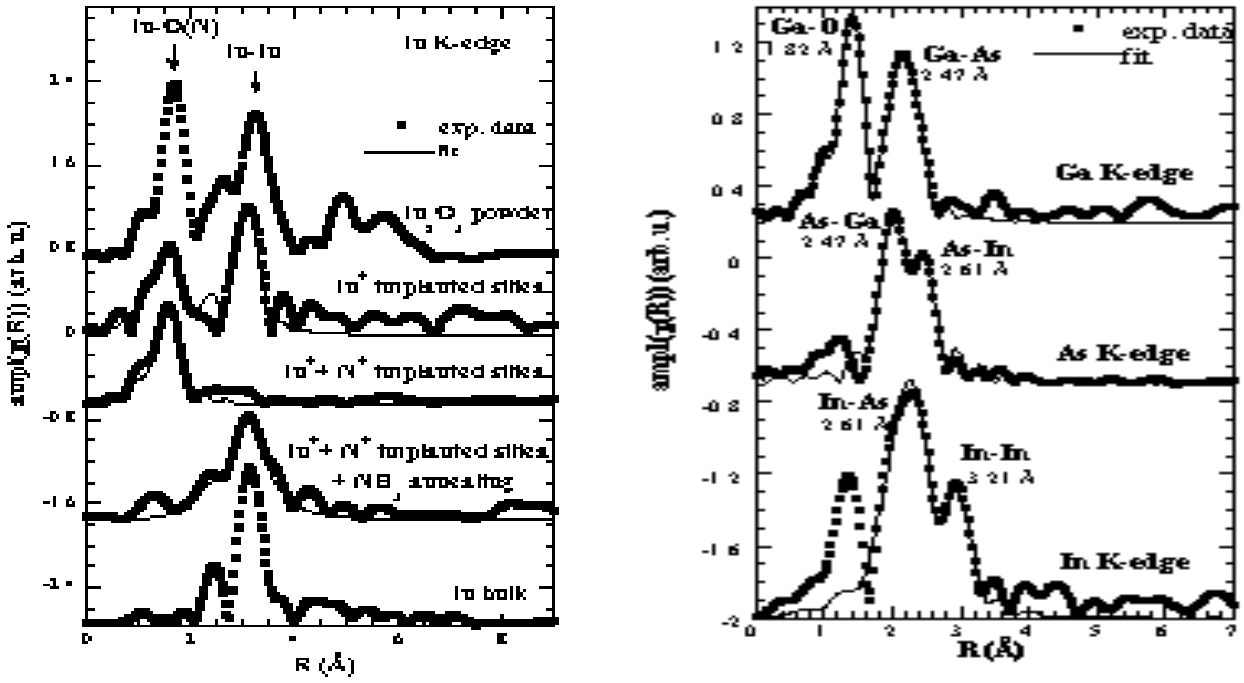

Fig. 1,2. Moduli of Fourier transforms (experimental data and fits) for the samples doped with In together with standard of In bulk and In_2O_3 powder (left) and for the triple-implanted sample at the respective three edges (right).

Publications

[1] E. Borsella, G. Battaglin, E. Cattaruzza, F. D'Acapito, C. de Julian, M.A. Garcia, F. Gonella, G. Mattei, C. Maurizio, P. Mazzoldi, S. Padovani, A. Quaranta, C. Sada, L. Tapfer, "Synthesis of wide band gap nanocrystals by ion-implantation", submitted to Nucl. Instrum. Meth. B.