



Experiment title: Study of annealing-induced As migration inside HgCdTe

Experiment number:
MA - 442

Beamline:
BM29

Date of experiment:
from: 25 February 2008 to: 29 February 2008

Date of report:
October 2008

Shifts:
12

Local contact(s): Dr. Olivier MATHON

Received at ESRF:

Names and affiliations of applicants (* indicates experimentalists):

Xavier BIQUARD* - CEA Grenoble INAC/SP2M/NRS

Isabelle ALLIOT* - CEA Grenoble INAC/SP2M/NRS

Philippe BALLET* - CEA Grenoble LETI/DOPT/SLIR

Report:

Our experiment on BM29 was successfully conducted.

Indeed, we were able to record XAS spectra on both our samples of As doped HgCdTe. This was a kind of challenge for this beamline because of the low As concentration of 10^{19} cm^{-3} , that is a concentration of $3 \cdot 10^{-4}$. To be successful, we had to open as much as possible beamline slits and to bring as close as possible the 13-element energy-resolved detector. Working so, we got some Bragg diffraction peaks from the ZnCdTe substrate impinging inside the detector. As is illustrated in figure 1 (first curve), these Bragg peaks produce artefacts rendering the recorded XAS spectra completely useless (refer to vertical bars). Therefore, we put the sample on a slowly rotating spinner and Bragg peak were successfully washed out as illustrated on figure 1 (second curve).

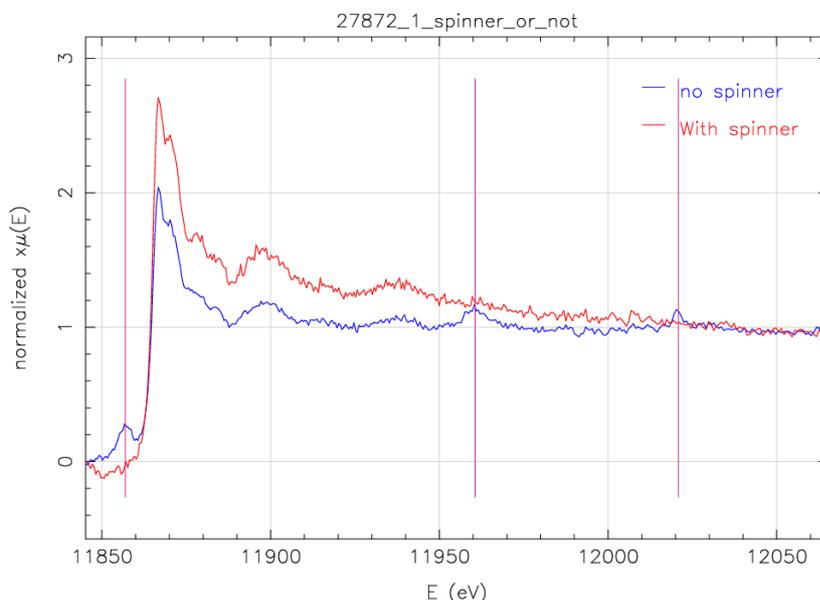


Figure 1: necessity of the spinner to record meaningful XAS spectra. Vertical bar emphasis Bragg diffraction peaks artefacts.

Given the low As concentration, acquisition time for spectra were relatively important of the order of 3 shifts (24H) per sample: the stability of BM29 was indeed an asset for us. Figure 2 shows the effect of the Hg-rich annealing on sample 24875 while figure 3 shows the effect on extracted EXAFS oscillations.

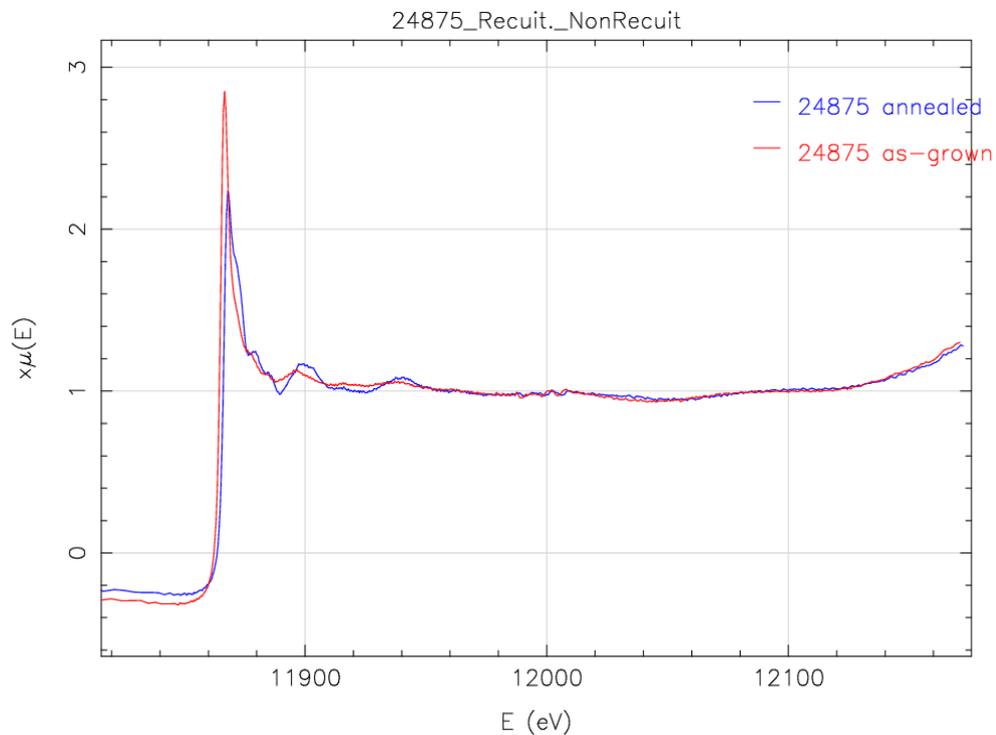


Figure 2: effect of the Hg-rich annealing on sample 24875

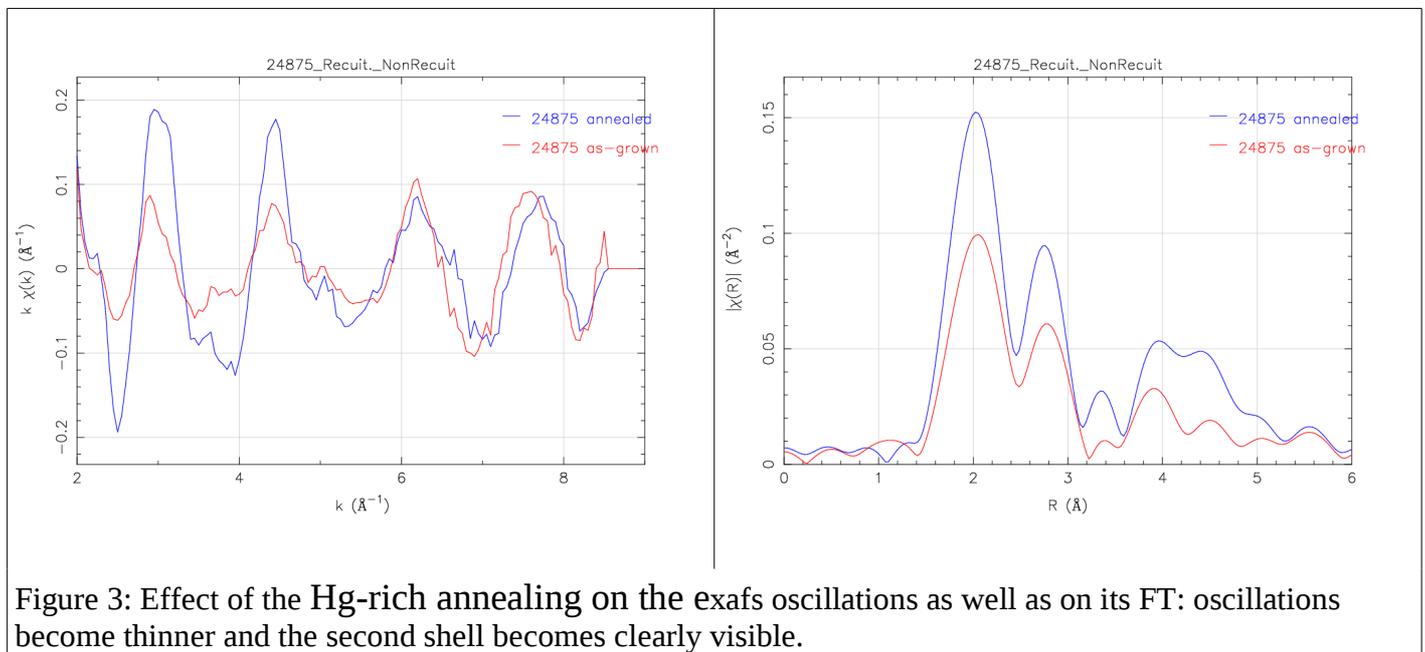


Figure 3: Effect of the Hg-rich annealing on the exafs oscillations as well as on its FT: oscillations become thinner and the second shell becomes clearly visible.

A complete data analysis (that will not be developed here) was conducted on data and showed that the commonly admitted scenario of an As migration from a Hg site to a Te site does not take place in our case. This analysis is the object of a communication at the 2008 US Workshop On The Physics And Chemistry Of II-VI Materials and a publication has been written which suggest another scenario.