



	Experiment title: High sensitivity, high spatial resolution analysis of metal contamination in silicon materials for solar cells	Experiment number: MA-652
Beamline: ID-22 Nanoprobe	Date of experiment: from: 9. Febr. 2009 to: 12. Febr. 2009	Date of report: 31 Aug. 2009
Shifts: 9	Local contact(s): Dr. Remi Tucoulou	<i>Received at ESRF:</i>
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Report:

Co-precipitation of different metals may provide a chance to cope with high metal levels in solar-grade silicon. Since the details of such co-precipitation processes are not satisfactorily understood, there is large interest in

Two types of Si samples were investigated during the beamtime: (i) model grain boundaries intentionally contaminated with Cu and Ni and (ii) samples from a Fe and Cu doped solar-grade Si block.

Previous investigations on the Cu/Ni model sample with low spatial resolution at BESSY had shown that Ni and Cu precipitates can be found at the same sites. The results obtained at the ID22 nanoimaging station revealed for the first time that the distribution of Ni and Cu is quite different from what one would expect for a homogeneous mixed phase of the two metals (Fig. 1, Fig. 2).

Similar results were obtained for the Fe/Cu co-doped solar-grade silicon (Fig. 3). The figure also shows that the metal precipitates grow along certain orientations.

According to preliminary estimates, the sensitivity of metal detection in our samples was very high. This renders detection of very small metal clusters possible.

Summary:

The results of the beamtime prove that the nanoimaging station allows very important detailed insights into precipitation of metals in solar-grade silicon materials. Having such tool available, systematic studies of the precipitation mechanisms (interaction between different metals, interaction with dislocations and grain boundaries) can be performed.

Publication of the obtained results is in preparation.

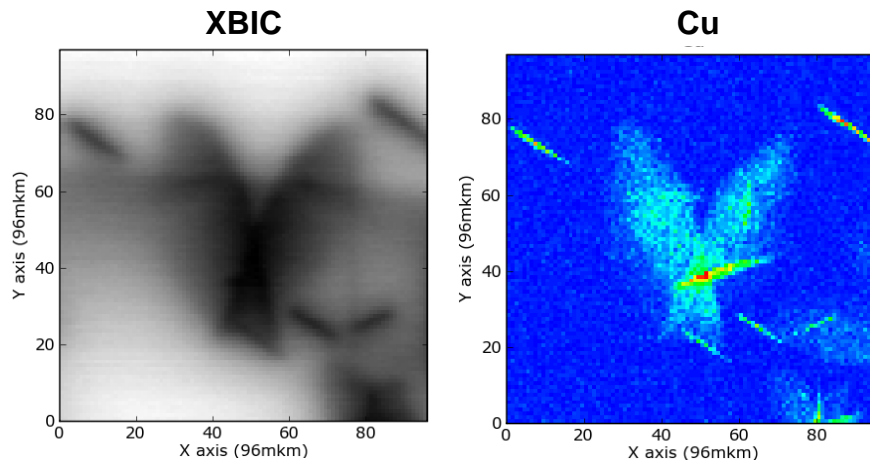


Fig. 1:
Map of electrical activity (left) and Cu distribution (right) in a Cu/Ni contaminated model sample

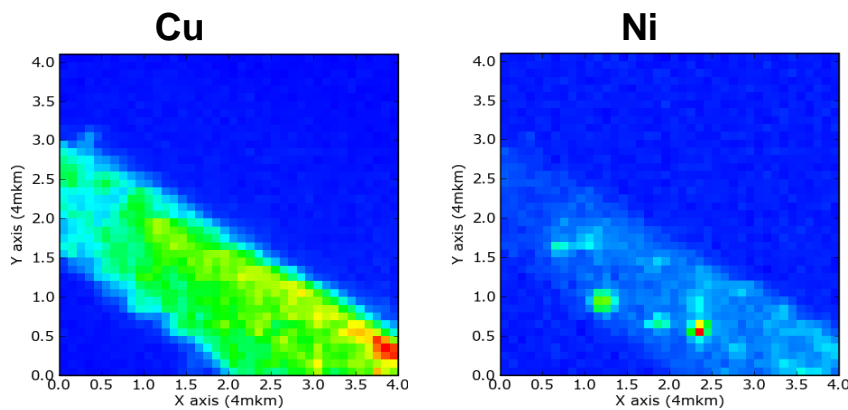


Fig. 2:
Cu/Ni contaminated model sample: significant differences in the distribution of Cu and Ni.

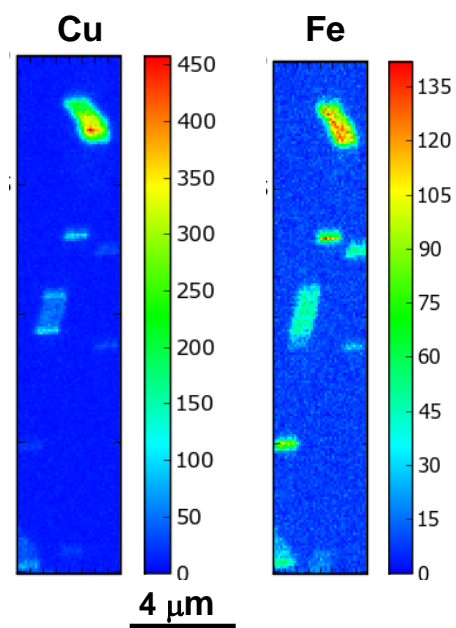


Fig. 3:
Cu and Fe precipitation in a solar-grade Si sample. Please note the differences in the Fe and Cu maps.