ESRF

ESRF	**Experiment title:** High sensitivity, high spatial resolution analysis of metal contamination in silicon materials for solar cells	**Experiment number**: MA-421
Beamline: ID-21	**Date of experiment**: from: 18 Febr. 2008 to: 25. Febr. 2008	**Date of report**: 12.01.2009
Shifts: 18	**Local contact(s)**: Dr. Murielle Salome	*Received at ESRF:*

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Report:

Published work:

W. Seifert, O. Vyvenko, T. Arguirov, A. Erko, M. Kittler, C. Rudolf, M. Salome, M. Trushin, I. Zizak, "Synchrotron microscopy and spectroscopy for analysis of crystal defects in silicon", phys. stat. sol. (c), in press

Abstract:
The paper discusses the synchrotron-based microprobe techniques XBIC (X-ray beam induced current), μ-XRF (X-ray fluorescence microscopy) and μ-XAS (X-ray absorption microspectroscopy) and their application for studying electrical activity of defects and precipitation of transition metals in Si materials. Investigations were performed on samples of block-cast multicrystalline Si and on model samples cut from a bonded monocrystalline wafer. To analyze the precipitation sites, Ni, Cu and Fe were introduced intentionally into the samples. The detected precipitates were found to consist of silicides. Evidence for metal precipitates was also found in virtually uncontaminated as-grown block-cast Si. Besides Ni precipitates detected at a recombination active grain boundary, particles containing one or several metals (Cu, Fe, Ti, V) were observed. Unexpectedly, these particles seem to exhibit low only recombination activity. Further studies are necessary to identify their nature.

W.Seifert, O. Vyvenko, T. Arguirov, M. Kittler, M. Salome, M. Seibt, M. Trushin,
“Synchrotron-based investigation of iron precipitation in multicrystalline silicon”,
Superlattices and Microstructures, in press
Abstract:
We report on investigations of the precipitation of iron in block-cast multicrystalline silicon using the techniques of X-ray beam induced current, X-ray fluorescence microscopy and X-ray absorption microspectroscopy. The samples studied were intentionally contaminated with iron and annealed at temperatures between 850 and 1050°C. Annealing at 950°C was found to lead to well detectable iron precipitation inside the grains and at grain boundaries. Small only iron clusters were detected after the 850°C anneal while no iron clusters were found after the 1050°C treatment. X-ray absorption near edge structure analyses of the iron clusters revealed mostly iron silicide and in one case iron oxide. Under the given condition at the beamline, the detection sensitivity for iron was estimated to be 4 $x10^7$ atoms, corresponding to a spherical $FeSi_2$ particle of 40 nm radius.