	Experiment title: *XNCD study of photo-induced gyrotropy in amorphous Selenium*	**Experiment number:** HE 1349
Beamline: ID12	**Date of experiment:** from: 28/01/2003 to: 04/02/2003	**Date of report:** 27/02/2004
Shifts:	**Local contact(s):** Dr A. Rogalev	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

A.V. Kolobov* - Center for Applied Near-Field Optics Research, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan,

A. Rogalev* - European Synchrotron Radiation Facility (ESRF)

N. Jaouen* - European Synchrotron Radiation Facility (ESRF)

F. Wilhelm* - European Synchrotron Radiation Facility (ESRF)

J. Goulon* - European Synchrotron Radiation Facility (ESRF)

Report:

Amorphous selenium is a material whose structure can be modified by exposure to light. Exposure at lower temperatures results in reversible structural modifications within the amorphous phase while exposure at room temperature usually leads to photocrystallization [1]. Of significant interest is the fact, demonstrated by different groups, that exposure of Se to linearly polarized light produces anisotropic structures [2-4]. All those measurements were performed using optical methods in the visible range.

It has also been demonstrated that exposure to binary chalcogenides to circularly polarized light produces gyrotropy [5]. Selenium, whose structure consists of weakly interacting helical chains, seems to be an ideal candidate to study photo-induced circular dichroism.

The purpose of the proposed experiment was to investigate photo-induced circular dichroism in thin films of amorphous Se. Measurements were performed at beamline ID12.

Samples were prepared by thermal evaporation in a vacuum, a typical film thickness was on the order of 0.1 micron to ensure uniform photoexcitation of the samples. As an inducing light source we have used lasers similar to those used in previous optical studies. The samples were mounted on a finger of a thermostat inserted into a special UHV sample chamber. The experimental XANES spectra were systematically corrected for self-absorption using a homographic transform [6]. As a reference, we have used a single crystal of trigonal Se with 3mm x 12mm x 0.3 mm dimensions.

Natural x-ray dichroism, both linear and circular, has been successfully measured on the single crystal reference sample.

Our various attempts to detect any measurable laser-induced x-ray dichroism in thin films of amorphous Se were unsuccessful. Although we were exactly reproducing the conditions under which photo-induced dichroism in visible range has been easily detectable, both for reversible photostructural changes within the amorphous phase and photocrystallisation, we could not detect any differences for different polarisation geometries.

Our present explanation of the failure of the experiment is that we were trying to detect the induced dichroism in-situ, i.e. under simultaneous exposure of the sample by the laser and x-rays. Most likely, large concentration of photoelectrons produced by x-rays prohibited the structural modification of Se by the laser. It has been demonstrated previously that simultaneous exposure of Se to two differently polarised laser beams can suppress the crystallization rate [7]. Regrettably, by the time we came to this conclusion, the beam time was already spent on various trails to induce dichroism using different temperatures and wave lengths.

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