EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:

https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Reports supporting requests for additional beam time

Reports can be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** In situ and real-time studies of the growth of mixtures of the organic semiconductiors alpha-sexithiophene and C60 buckminster fullerene	**Experiment number**: SC-4018
Beamline: ID03	**Date of experiment**: from: 28. Jan 2015 to: 03. Feb 2015	**Date of report**: 10.09.2015
Shifts: 18	**Local contact(s)**: Maciej Jankowski	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

Overview

Thin films of α-sexithiophene (6T) and C_{60} mixtures deposited on nSiO substrates at 303 K and 373 K were investigated in real-time and *in situ* during the film growth using X-ray diffraction. In the mixtures, the well-known 6T low-temperature crystal phase and the β-phase are observed, which usually coexist in pure 6T films, to a certain extend. The addition of C_{60} modifies the structure to almost purely β-phase dominated films in the case of 303 K substrate temperature. On the other hand, at 373 K substrate temperature the low-temperature crystal phase of 6T dominates the film growth of the mixtures. Post-growth annealing of pure 6T films results in strong increase of film ordering, whereas annealing of equimolar 6T:C_{60} mixed films does not induce any significant changes in the film structure. These results lend further support to the important influence of C_{60} on the growth behaviour and structure formation process of 6T in mixtures of the two materials.

Quality of measurement and data

The ID03 beamline is very suitable for interface/surface scattering *in situ* and in real-time. The data are of high quality with a good signal-to-noise ratio in spite of the fact that the

scattering signal from the thin organic layers (~ 20 nm) is relatively weak. Thanks to the very stable beam and the excellent experimental conditions at the beamline, we were able to measure all samples we aimed for. In order to follow the growth, grazing incidence X-ray scattering (GIXD) scans were performed during film growth. All the films were characterized post-growth using X-ray reflectivity (XRR), high-resolution GIXD and reciprocal space maps. For the latter, the software BINoculars, provided by the beamline staff was a great support.

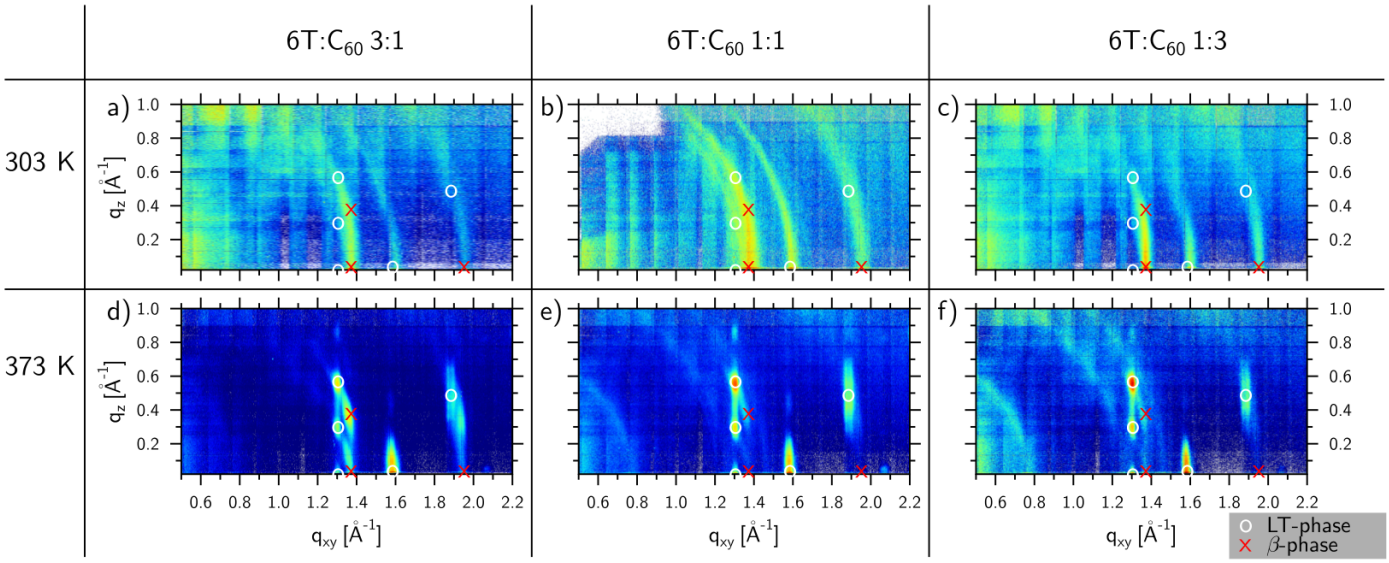

Figure 1: 2d reciprocal space maps of six different 6T:C 60 mixtures. In the mixtures prepared at low substrate temperatures (a-c, top row) the peaks of 6T are smeared out and not very well defined. The rings usually seen for C_{60} are not observed, since their signals rather low. In the mixtures prepared at high substrate temperature (d-f, bottom row) the 6T peaks are relatively well defined. In the 6T:C_{60} (1 : 1) and (1 : 3) mixtures (e and f, respectively), weak rings arising from the C_{60} are visible. The images were taken with a MaxiPix area detector and composed of 147 single pictures using the BINoculars software.

Status and Progress of evaluation

All the data are evaluated and the manuscript
"Growth and Annealing Kinetics of α-Sexithiophene and Fullerene C 60 Mixed Films"
by the authors
C. Lorch, K. Broch, V. Belova, G. Duva, A. Hinderhofer, A. Gerlach, M. Jankowski, and F. Schreiber
is submitted to the "Journal of Crystal Growth and Design".

We would like to thank our local contact Maciej Jankowski and the complete staff of the ID03 beamline for their excellent support.