ESRF	**Experiment title:** Study of the temperature dependent local structure of doped $La_2CuO_{4.1}$ superconducting material	**Experiment number:** HS22
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Report:

The aim of the experiment was to investigate the stripe structure of the two dimensional superconducting CuO_2 plane that is relevant for understanding the basic aspects related with mechanism of high Tc superconductivity. Oxygen doped La_2CuO_{4+x} i's the simplest system to study the ordering of dopants. mobile oxygens, and the modulation of CuO_2 plane in high T_c superconductors.

The diffraction experiment was made on a single crystal of $La_2CuO_{4.1}$ (Tc = 38K) doped by electrochemical oxidation. This oxygen doped crystal shows a single crystallographic phase while all the samples studied so far by other groups have a lower oxygen concentration and they show a phase separation between oxygen doped and undoped domains.

We have undertaken a detailed diffraction study using hard x-ray energy photons of 25 KeV. We have collected at room temperature the data in the K geometry using an 35x43 cm imaging plate and the sample oscillation around the b axis in a range $0<\phi<10°$, where ϕ is the angle between the direction of the photon beam and the a axis. We have investigated a portion of the reciprocal space up to 0.6 $Å^{-1}$ momentum transfer i.e. recording the diffraction spots up the maximum indexes 3, 3, 19 in the a*, b*, c* direction respectively. In this geometry the intensities are mainly sensitive to displacements along the c axis.

The crystallographic lattice parameters of our crystal are a=5.351 A, b=5.418 Å, c=13.171 A. Thanks to synchrotron radiation it has been possible to record a large number of weak superstructure spots around to the main peaks of the average structure.

The indexing of the superstructure has been very difficult due to the twinning of the crystal and coexistence of 3 incommensurate modulations. The first one shows a pattern of diffuse spots due to the superstructure with a period of about 3c along the c axis

q_1=0.207 b*, 1/3 c*,

that coexists with two related superstructures characterised by narrow peaks

q_2= 0.26 b*, l/2 c*;

q_3=- 0.25 b*, 1/2 c*

with a period 2c along the c axis. The in plane modulation (b-axis direction) of the first diffuse superstructure is the same as that found in Bi2212 at optimum doping (1) .

These type of superstructure give one-dimensional modulation of the CuO_2 plane forming a striped structure. The first one has the same period as in Bi2212 and it can be associated with superconducting domains with a characteristc hole doping of 0.2 holes per Cu site.

The results of this experiment have been reported at the International Conference on “Stripes and Lattice Instabilities in high Tc superconductors” held in Rome 8-12 Dec. 96.

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