



Experiment title:

**STUDY OF THE TEMPERATURE DEPENDENT
LOCAL STRUCTURE OF DOPED $\text{HgBa}_2\text{CuO}_{4+\delta}$
SUPERCONDUCTING MATERIAL BY EXAFS**

**Experiment
number:
HS-39**

Beamline:
D-32, CRG

Date of experiment:

from: to:

Date of report:

Shifts:
15

Local contact(s):
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Received at ESRF:

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R e p o r t :

The measurements were made on powder sample of Hg1201 and single crystal samples. The preliminary analysis of the data for the powder samples shows anomalous behaviour of the temperature dependence of the Debye Wailer of the Cu-O(planar). The detailed analysis ius being done.

We were able to measure a single crystal sample of the Hg1212 system. The results are reported in the XAFS-IX.

The local structure of the $\text{Hg}_1\text{Ba}_2\text{CaCu}_2\text{O}_{6+d}$ (Hg 12 12) crystal has been investigated by temperature dependent polarized Cu K-edge extended x-ray absorption fine structure (EXAFS). Fourier transform of a typical spectra is shown in Fig. 1.

We have observed an anomalous behavior of the local structure showing anomaly at around the superconducting transition temperature T_c in the temperature dependence of the Cu-O(planar) distance. Fig. 2 shows the anomalous behaviour of the Cu-O(planar) distance. The result suggests similarity of the temperature dependent local instability in the superconducting cuprates.

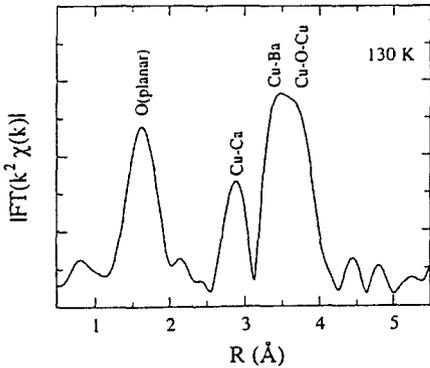


Figure 1: Fourier transform of the experimental E//ab

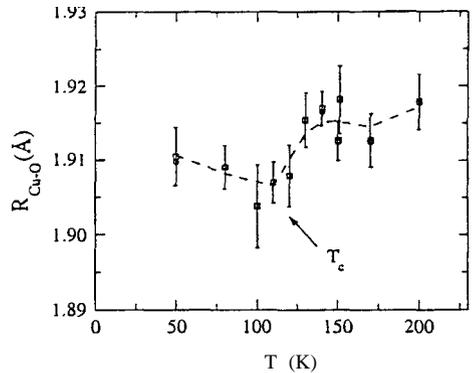


Figure 2: The temperature dependence

The temperature dependence of the Cu-O(planar) distance is shown in the Fig. 2. The Cu-O(planar) distance is temperature dependent and there appears to be anomalous change at T_c . This anomalous behavior is similar to one observed in the other cuprate superconductors. The result suggests that inhomogeneity of the CuO_2 plane, responsible for the anomalous behaviour, is a common feature for high T_c superconductivity.

The similarity in the structural anomalies at around the superconducting transition temperature T_c merely highlights the importance of the correlation between the charge and the lattice distortions for the superconductivity in the high T_c cuprate superconductors. The local lattice instability at low temperature has been associated with charge Focalization in a distorted local lattice i.e., polarons that coexist with itinerant charge carriers in the metallic undistorted CuO_2 plane.

Further work is needed to determine the structural distortions quantitatively.