ESRF	**Experiment title:** EXAFS analysis of the local structural distortions of Cu-O bondlengths and of the Nd/Ba substitution in $Nd_{1+x}Ba_{2-x}Cu_3O_{7-\delta}$ superconducting films	**Experiment number:** HS 1231
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Report:

The applications of the High critical Temperature Superconductors (HTS) in microelectronics are limited by two main reasons: the absence of a satisfactory understanding of the microscopic mechanisms of the superconductivity in these compounds and the inherent difficulties in growing HTS films with crystalline perfection. In fact the very short coherence length of the HTS (ξab=10-30 Å ξc=3-8 Å) requires the fabrication of almost perfect films in order to assure reproducibility and high performance of active and passive devices.

In order to investigate the correlation between the superconducting and the induced structural disorder due to local cationic substitution and oxygen loss in thin films, we have performed EXAFS measurements on several REBaCuO samples. In particular the $Nd_{1+x}Ba_{2-x}Cu_3O_{7-\delta}$ system offers a unique opportunity for studying the cationic disorder because it is possible to control the amount of Nd - Ba ions exchange.

For comparison we studied also superconducting $Y_1(Nd_{0.1}Ba_{1.9})Cu_3O_{7-\delta}$ film and semiconducting $PrBa_2Cu_3O_{7-\delta}$ films.

We collected EXAFS spectra on the following thin films: $Nd_1Ba_2Cu_3O_{7-\delta}$ (Tc=90K), $Nd_{1.1}Ba_{1.9}Cu_3O_{7-\delta}$ (Tc=60K), $Y_1(Nd_{0.1}Ba_{1.9})Cu_3O_{7-\delta}$ (Tc=86 K), $PrBa_2Cu_3O_{7-\delta}$. Measurements from bulk pellets of the same material have been also collected at room temperature.

The spectra have been collected in fluorescence mode with the samples mounted in an helium exchange gas cryostat and using a photo-diode as detector. We collected data with the incident beam polarization parallel to both ab and c axes of the epitaxial films, in order to discriminate the different contributions to total EXAFS signal coming from the different in plane and out of plane atom configurations. In figure 1 we show the fourier transform of the $k^2\chi(k)$ signals for a Nd rich pellet at room temperature and those for Nd rich film (with polarization parallel to the c-axis) acquired at different temperatures down to 30 K.

As first remark it should be noted that some peaks which are overlapped in the fourier transform of the bulk spectrum, are well separated in those of film spectra. This proves that large information can be obtained from measurements on epitaxial films with the suitable choice of the beam polarization. For example peak present in bulk fourier transform around 2.3 Å is divided in two peaks in case of film.

Data analysis is currently in progress. Two different codes are considered for the structural data extraction: GNXAS and EXCURVE. Preliminary analyses are promising. Regular changes of the structural parameters especially, for the in plane and apical CuO bonds together with the buckling angles, seems to be affected by the amount of cationic disorder. A quantitative analysis of the effect of the temperature, of the kind of rare earth and of the cationic disorder is presently in progress.

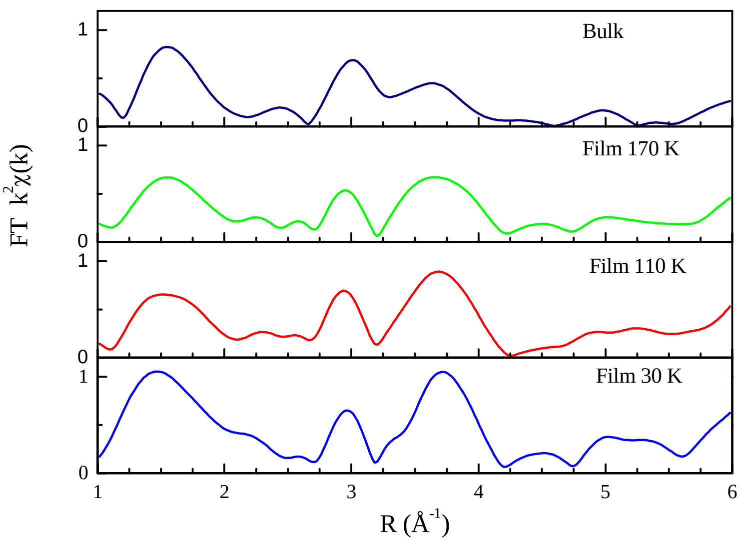

Figure 1. Plot of the fourier transform of $k^2\chi(k)$ signal of: $Nd_{1.1}Ba_{1.9}Cu_3O_{7-\delta}$ pellets at room temperature (a), $Nd_{1.1}Ba_{1.9}Cu_3O_{7-\delta}$ film at 170 K (b), 110 K (c), 30 K (d).