ENHANCED RESONANT SOFT X-RAY SCATTERING $YBa_2Cu_3O_7-x$ 50 nm THIN FILMS ON BYCRISTALLINE SUBSTRATES

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1. INTRODUCTION: YBa2Cu3O7-x GRAIN BOUNDARY JOSEPHSON JUNCTIONS

- Josephson junctions: structure consisting of two superconductors called electrodes separated by a thin layer called barrier.
- The barrier coupling the two superconductors can be insulator (tunnel junctions) or semiconductor, normal metal or alloy, or another superconductor with reduced critical parameters (weak links).
- The current across a high angle grain boundary in YBa2Cu3O7-\(x\) (YBCO) thin films is several orders of magnitude lower than that of an epitaxial film; behaves as a weak link or grain boundary Josephson junctions (GBJJs).

Bicrystals substrates: two single crystals cut at different angles, polished and fused together. A tilt grain boundary is formed at the interface of the two single crystals. The grain boundary is transferred to the thin film deposited on the bicrystal substrate and the grain boundary in the barrier of the junction.

2. MOTIVATION AND OBJECTIVE

- Experimental observations of the grain boundary in YBCO GBJJs: the barrier is a very disordered region.
- The strain fields of dislocations perturb the local structure, mainly in the YBCO oxygen sublattice in the barrier and in the adjacent regions even leading to non-superconducting zones.
- OBJECTIVE: to obtain some compositional information, mainly related to the oxygen content, in different positions along the normal direction to the grain boundary.

3. EXPERIMENTAL

3.1. Samples fabrication

- YBCO thin films are grown in a high pressure pure oxygen sputtering system at Applied Physics Department (Complutense University).
- The thickness of the samples fabricated is around 50 nm. The critical temperature for the films is in the range 89.5-91 K.

3.2. XAS measurements

- X-Ray absorbance at O(K-Edge) is measured at the beam scattering geometry by the enhancement of the YBCO [001] diffraction peak at station 6.3.1 of ALS (J. Kortright, Stanford).
- Measurements: at different positions across the grain boundary.

4. RESULTS AND DISCUSSION

- We have compared our Cu and O spectra to the previously data reported by other authors in YBCO single crystals for different values:

- We believe two phases with different \(x\) value (grain boundary and adjacent regions) are present in the YBCO thin film deposited on the bicrystalline substrate.

- We can obtain qualitative information of the contribution of these two phases along the normal direction to the grain boundary.

5. CONCLUSION

- Qualitative information of the composition of the YBCO deposited on a bicrystalline substrates can be obtained from the analysis of the spectra collected in different regions along the grain boundary in the beam scattering geometry by the enhancement of the YBCO [001] diffraction peak.
- We have measured that the crystallographic grain boundary is a region mostly deficient in oxygen but not to affect to the adjacent regions as well.
- The symmetry of the FT, the \(T\) and \(x\) dependence may be discussed for the O(K-Edge) spectrum absorption. The arcs in the FT show the contributions of the real and imaginary components of the scattering.