

Effect of Texture on Critical Currents in Bi-2212 Bulk Superconductors

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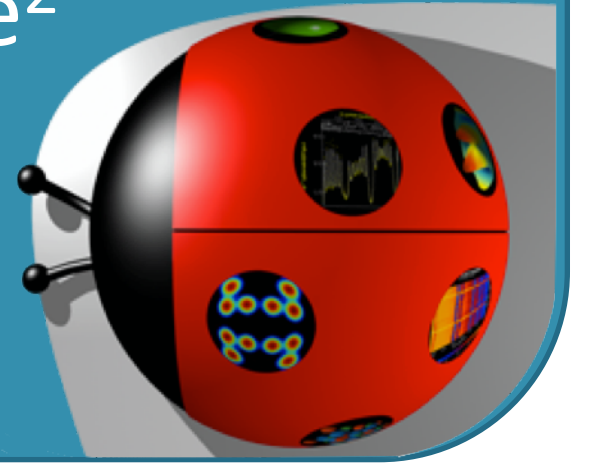
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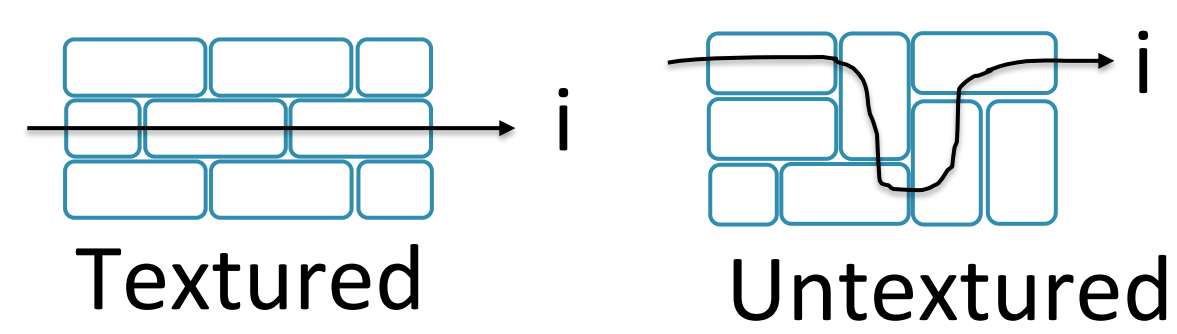
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Introduction

Studied materials are Bi₂Sr₂CaCu₂O₈ bulk superconducting tubes and rods
 Bulks show high supercurrents ($J_{c(77K, sf)} \sim 5 \text{ kA/cm}^2$) even with weak texture



Industrial applications : Fault current limiters, Current Leads, magnetic screens, trapped-field magnets

Conclusions

Multiphasic samples with Bi2212 as the main phase

Bi2212 texture is weak(?) both in rods and tubes

Microscale texture slightly differ from macroscale texture

Diffraction and microscopy show that ab planes of Bi2212 are

- Perpendicular to the samples axes
- Rotating around c axes with different angles

Resistivity measurements in a rod section show no c-axis component

Objectives

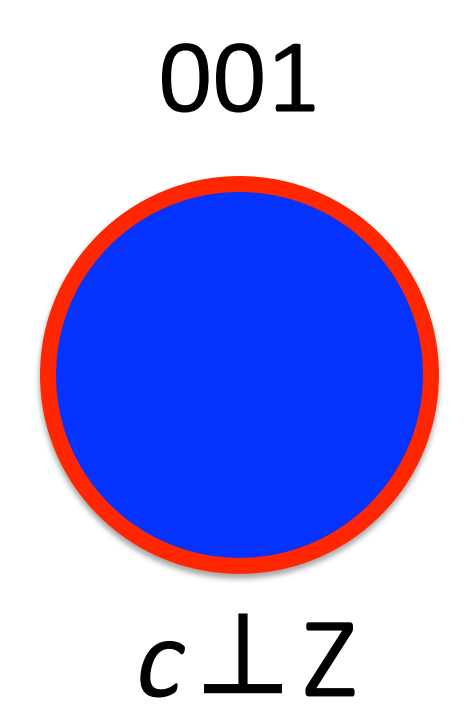
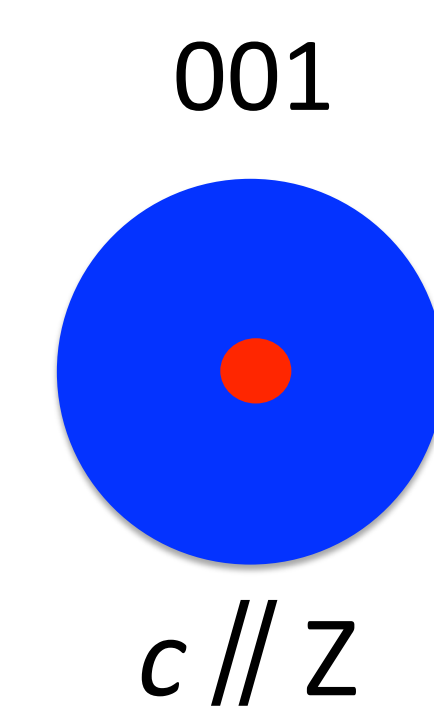
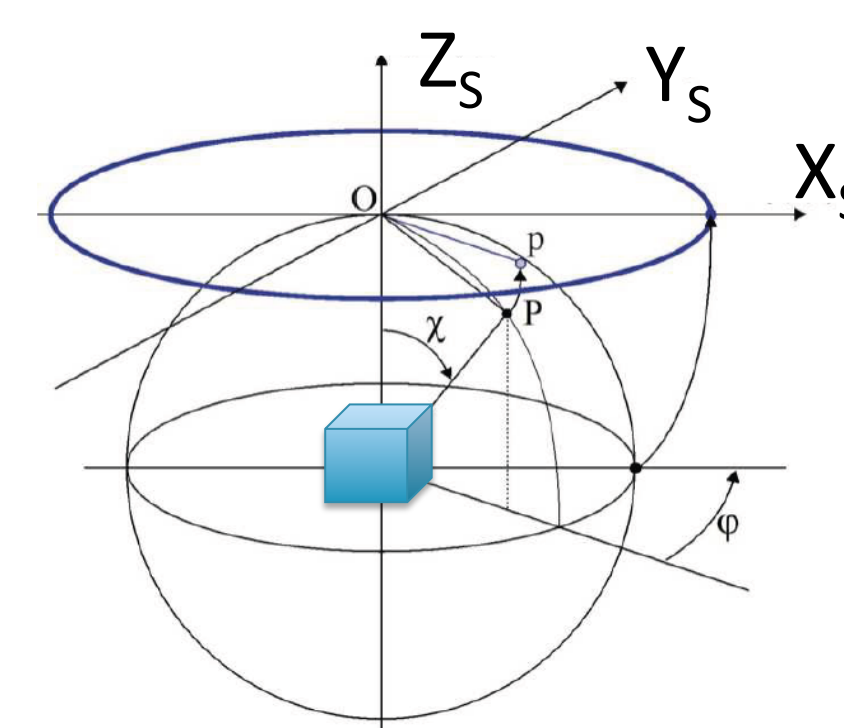
Use of Combined Analysis method: neutron (macroscopic), X-ray (near-surface), and electron diffraction (microscopic)

↳ Study of texture bulk superconducting samples of Bi₂Sr₂CaCu₂O₈

↳ Study of the effect of texture on J_c

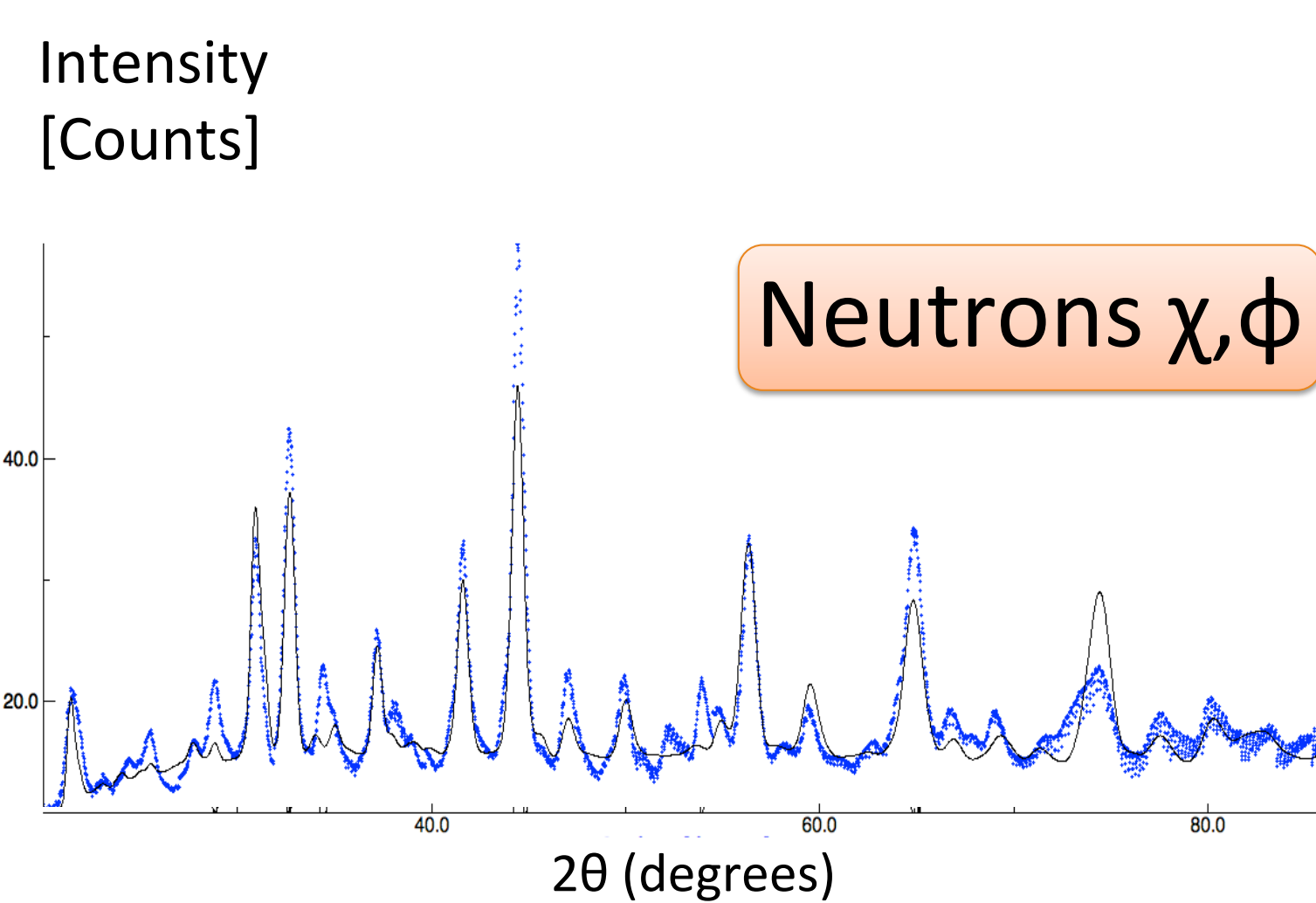
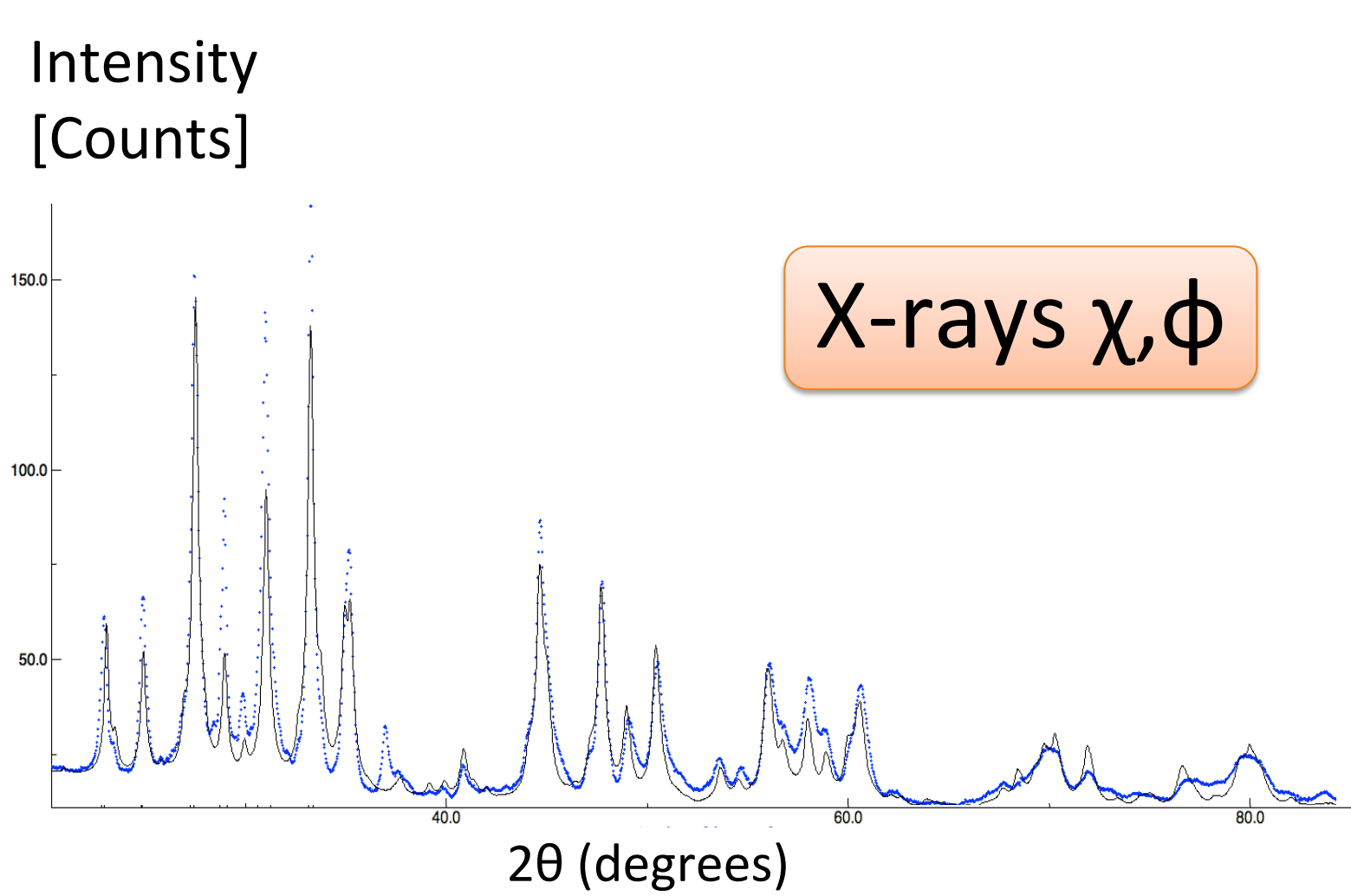
Study the effect of different parameters (shape, oxygen content,...) on J_c

Pole figures

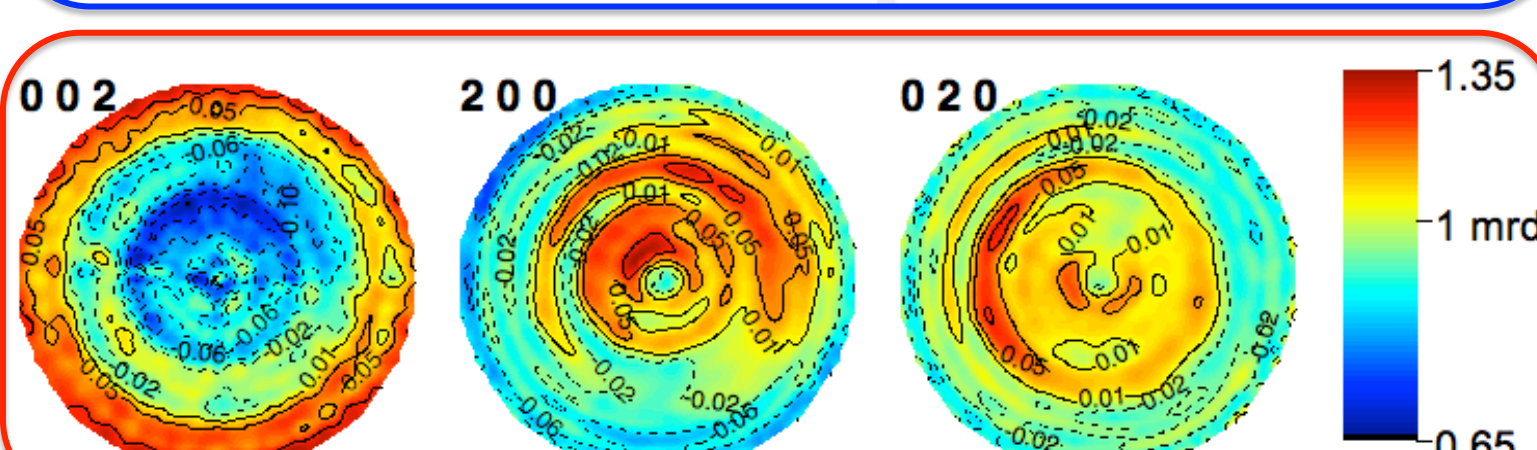
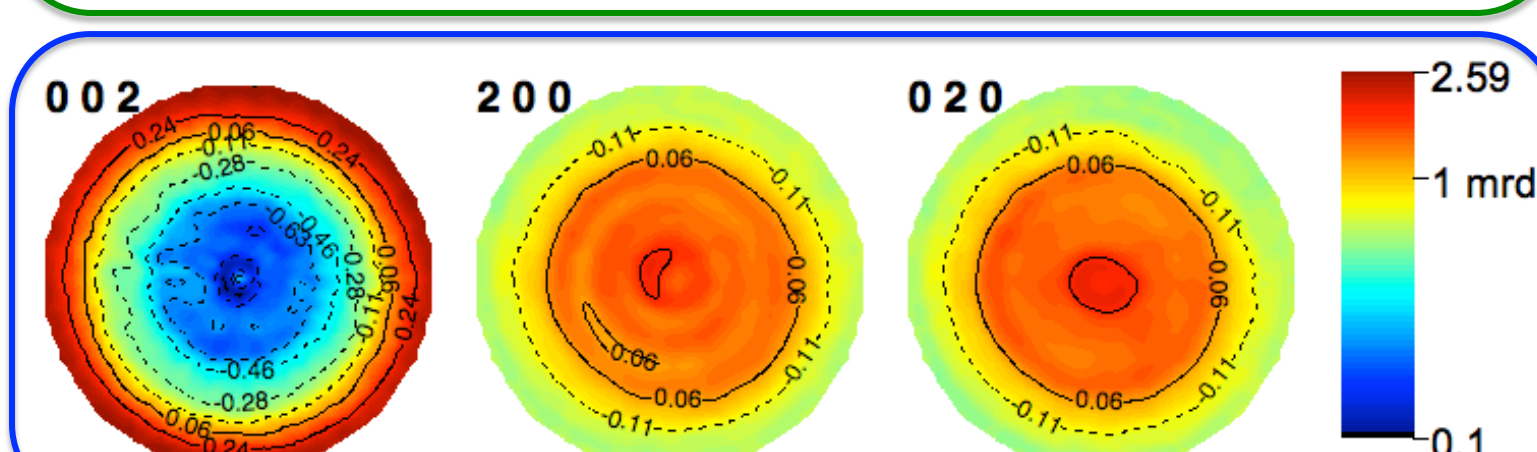
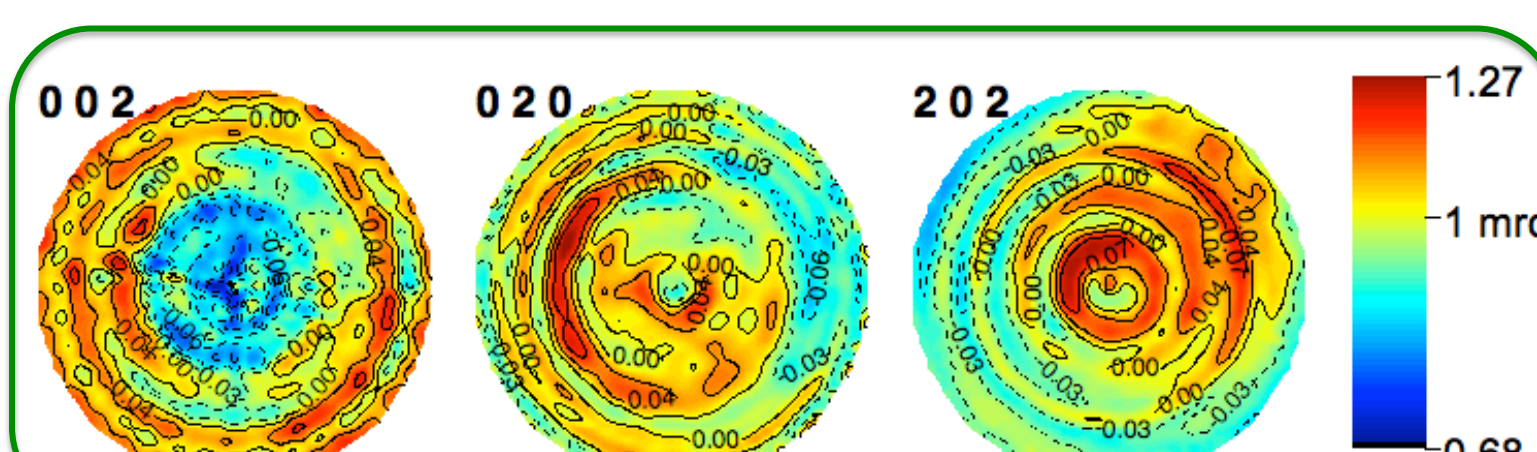
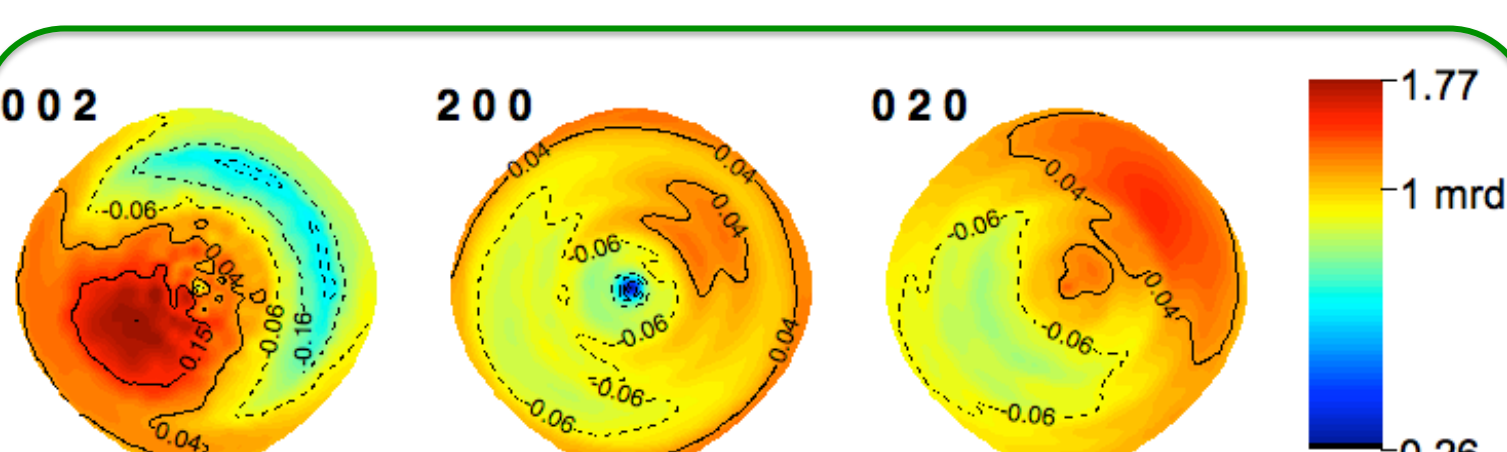
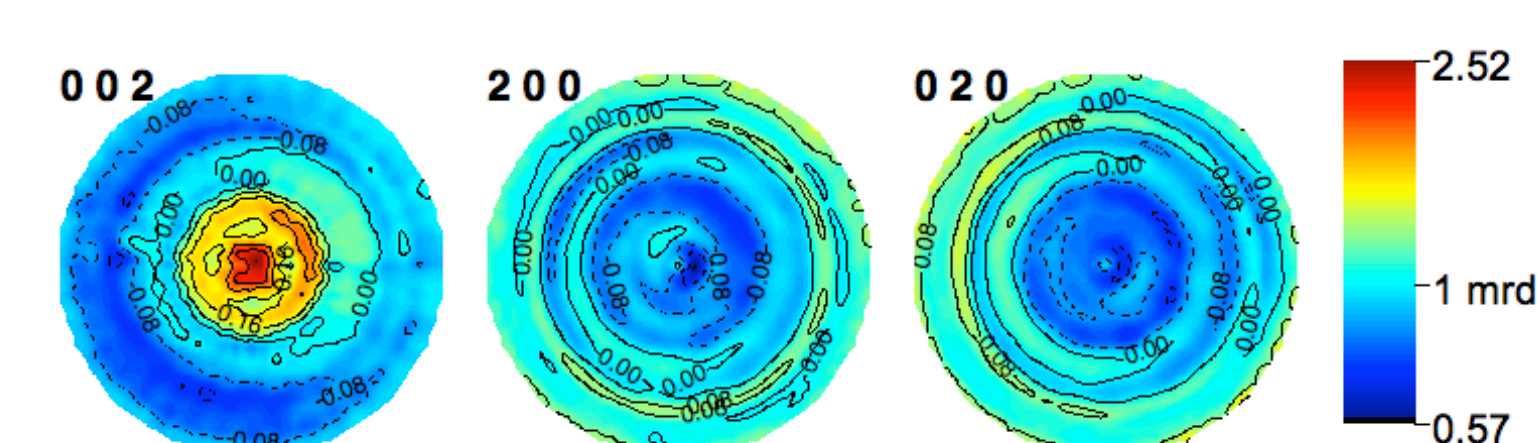
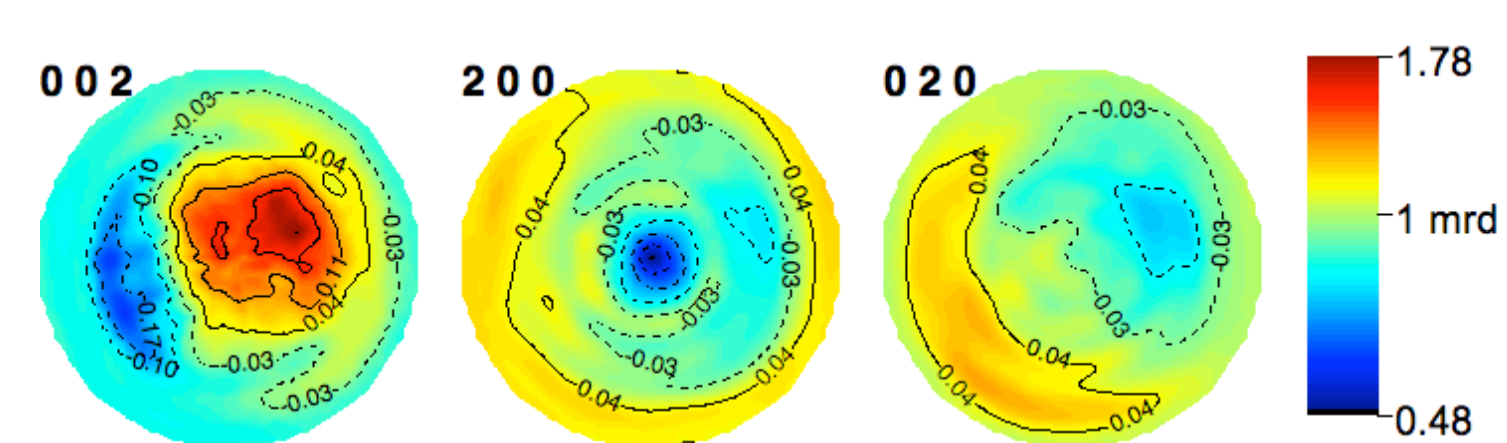


Results

Powder diffraction



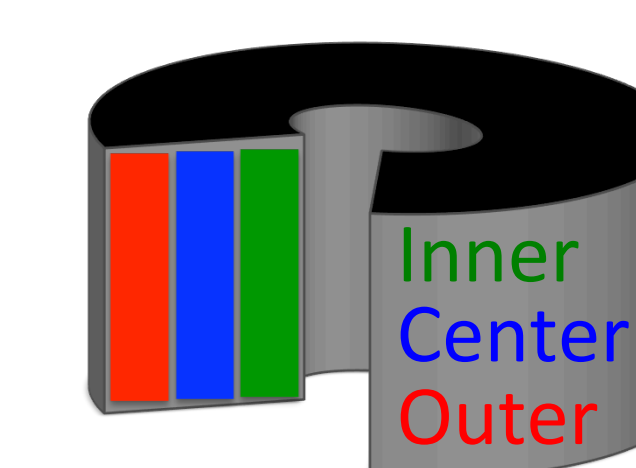
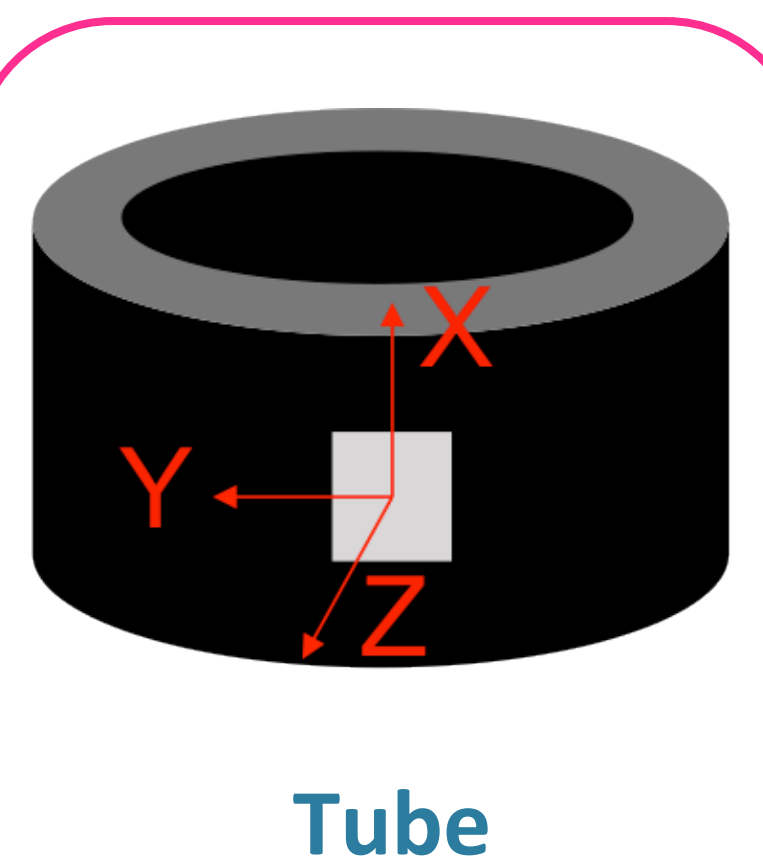
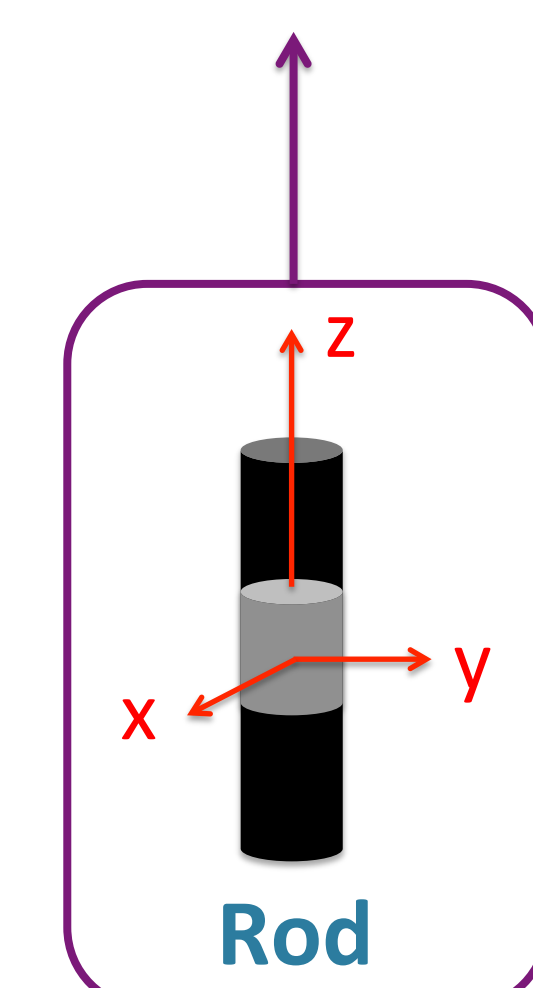
Diffraction patterns of bulk rod section measured with x-rays and neutrons by varying χ and ϕ angles. Data profile is in black and calculated profile is in blue.



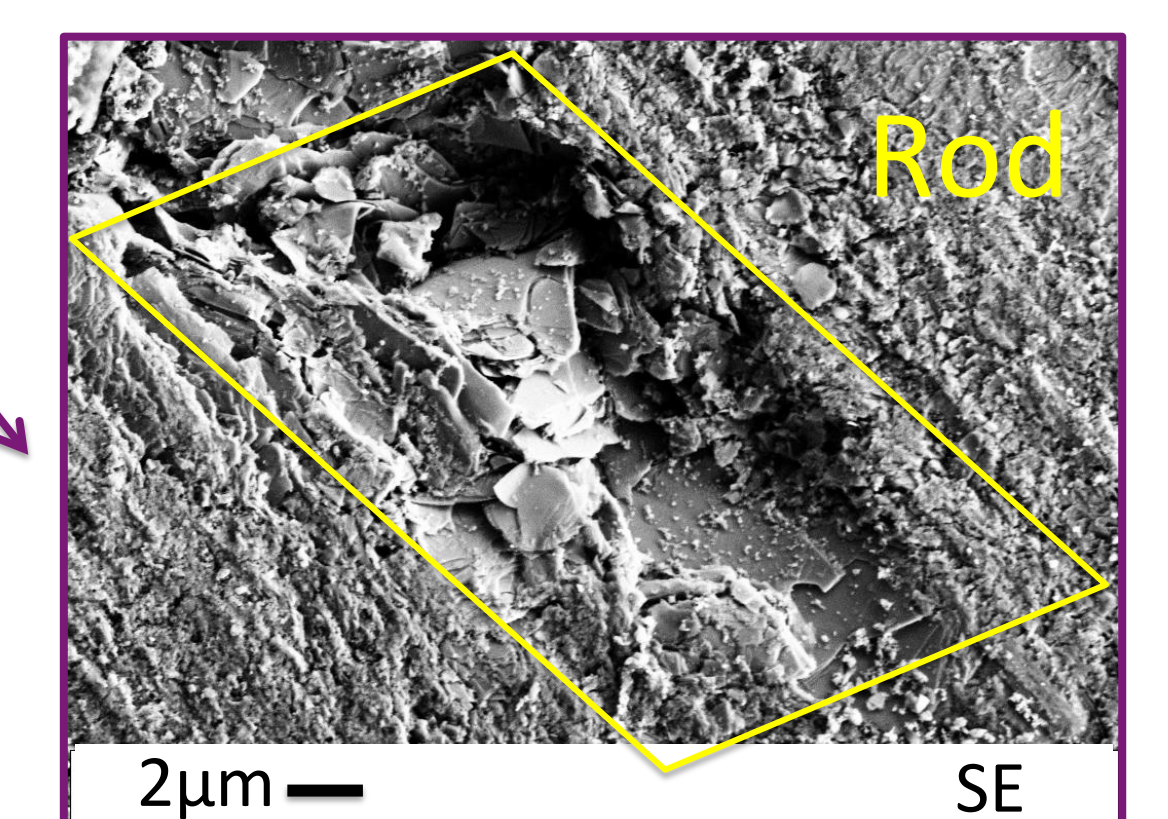
Normalized pole figures of rod and tube sections for data obtained from x-ray (left and neutron (right) measurements. Macroscopic texture obtained with neutron differ from microscopic texture (X-rays). Macroscopically all ab planes are perpendicular to the sample axis while at a microscopic scale, pole figures show... (to be continued with the images)

Resistivity

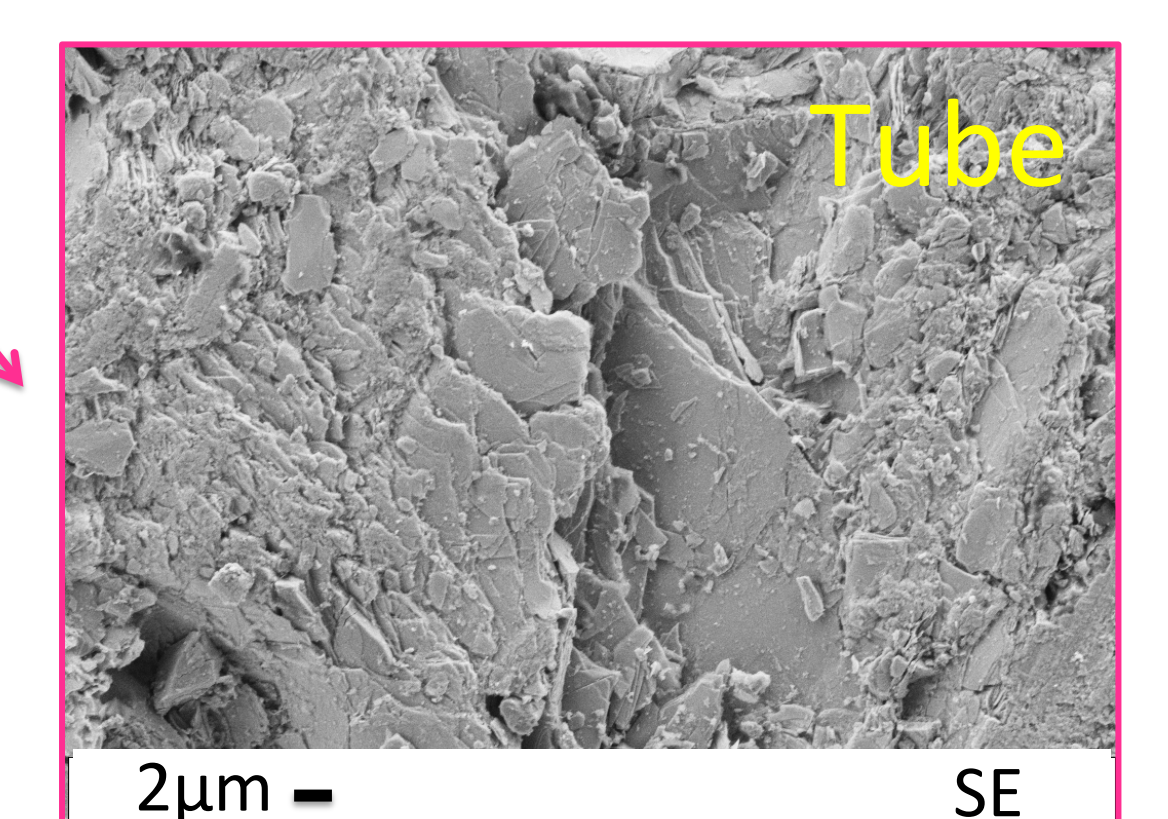
Resistivity measurements at 0 Tesla show no c-axis component when the voltage drop is measured on a 1mm thin circular slice. Resistivity is homogenous along the diameter of the rod.



Electron microscopy



ab planes ⊥ to the rod axis



ab planes ⊥ to the tube axis