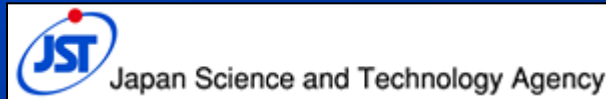




*AIST (Kansai)
Special Division of Green Life Technology*



CREST



*CRISMAT Laboratory
(Caen, France)*

Quantitative texture analysis of single crystal/ powder $\text{Ca}_3\text{Co}_4\text{O}_9$ composite materials

E. Guilmeau, K. Chong, M. Mikami, D. Chateigner and R. Funahashi

JSAP, Tokyo, March 29, 2004

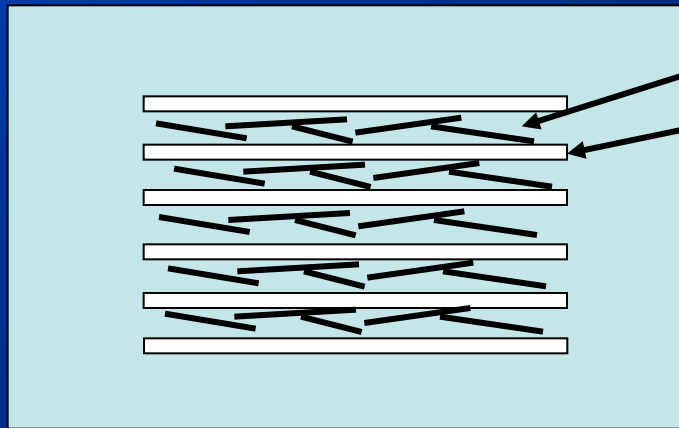


* Materials

** Quantitative Texture Analysis

*** Texture \leftrightarrow TE properties
Relationship

Three composite samples : Powder + single crystals



Single Crystals

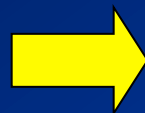
30 Discs (Powder)

Composition :

100%wt Powder

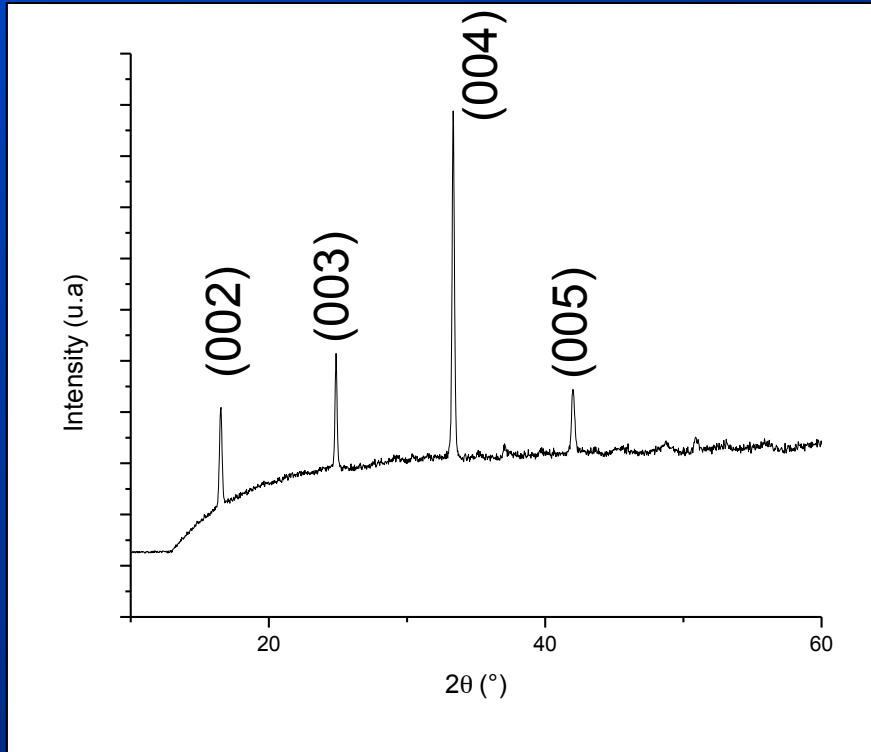
90%wt Powder + 10%wt Single Crystals

80%wt Powder + 20%wt Single Crystals

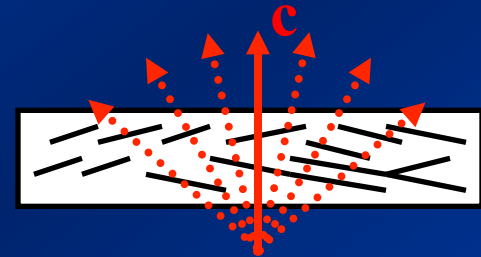


Hot-Pressing

(00 l) Texture



Degree of orientation ???



Lotgering ~~factor~~ method

Insufficient to quantify
the texture strength!!!

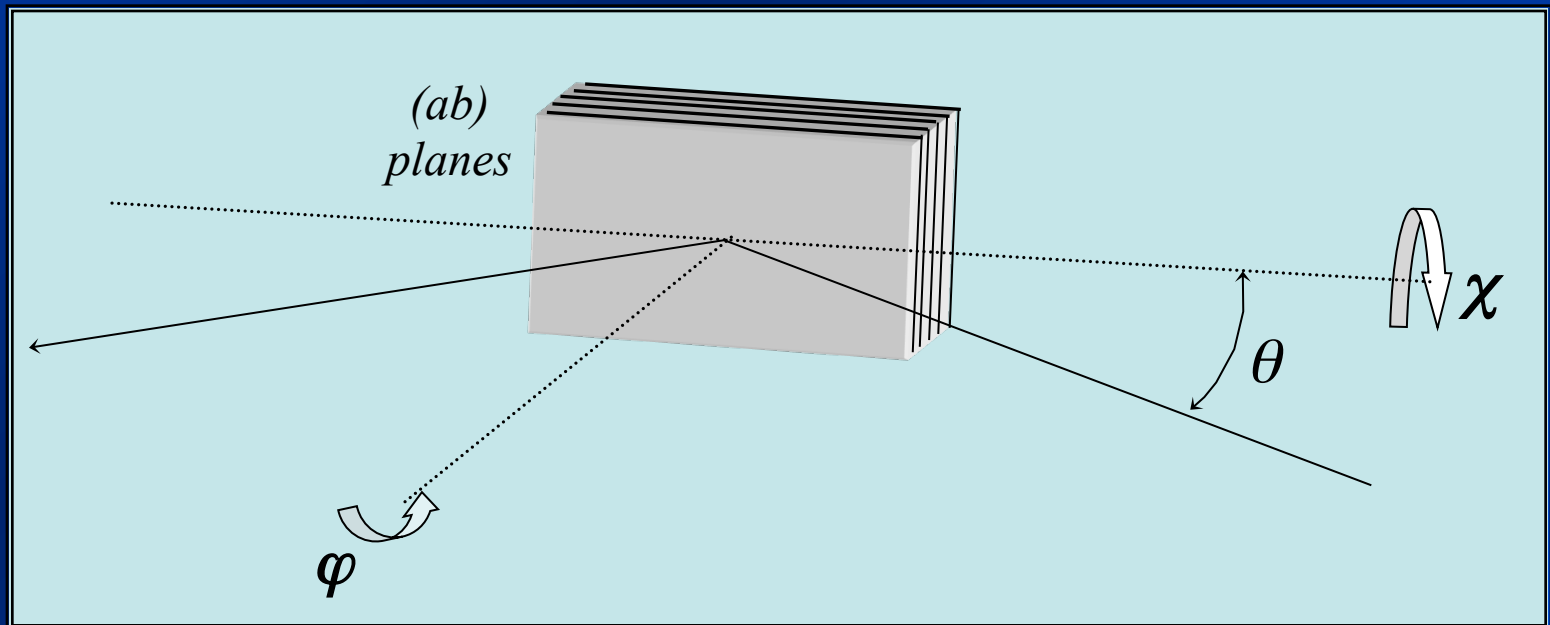
- ◇ Only one sample orientation does not provide any information on the orientation distributions
- ◇ Overlapping → deconvolution (problem!!!)
- ◇ if only (00 l) are observed, $f=1$ for many possible degrees of orientation.

A quantitative approach
is necessary!!!!

$$\text{Distribution Density : } D_{hkl}(\chi, \varphi) = \frac{I_{hkl}(\chi, \varphi)}{I^r_{hkl}} \quad (\text{m.r.d})$$

$I_{hkl}(\chi, \varphi)$: Integrated intensity of the $\{hkl\}$ peak for the (χ, φ) orientation of the sample

I^r_{hkl} : Integrated intensity of the same sample without texture.

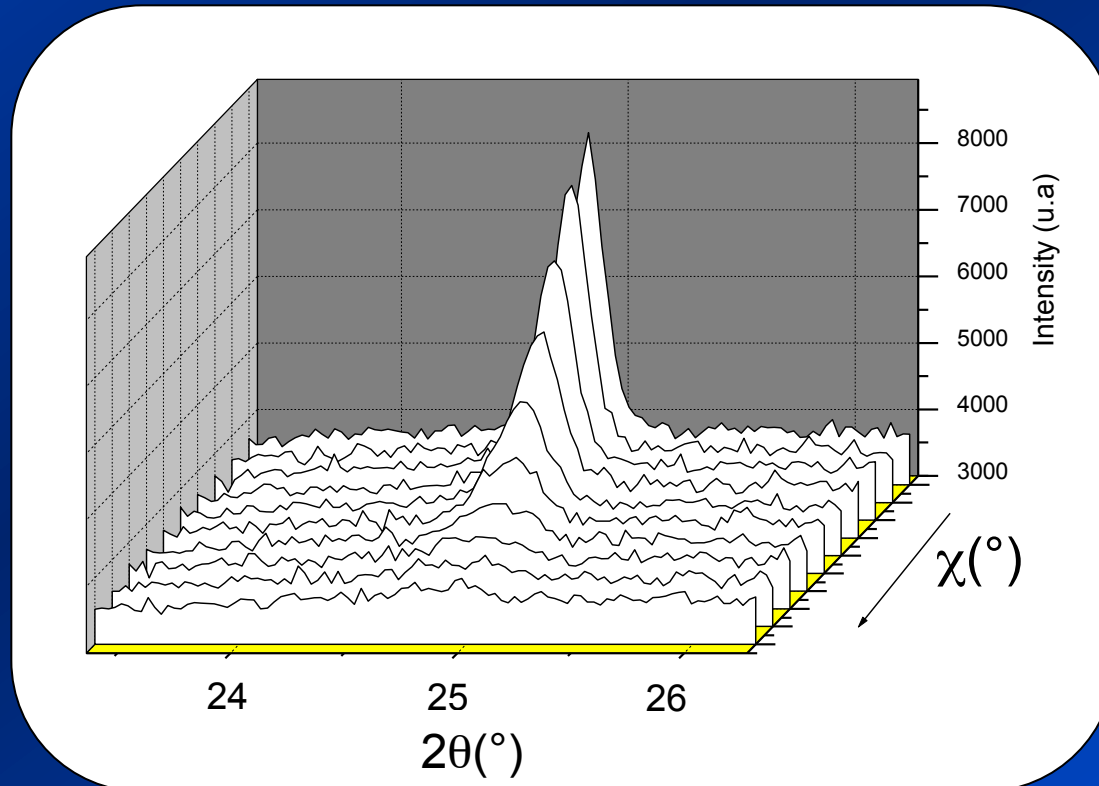


A quantitative approach
is necessary!!!!

$$\text{Distribution Density : } D_{003}(\chi, \varphi) = \frac{I_{003}(\chi, \varphi)}{I'_{003}}$$

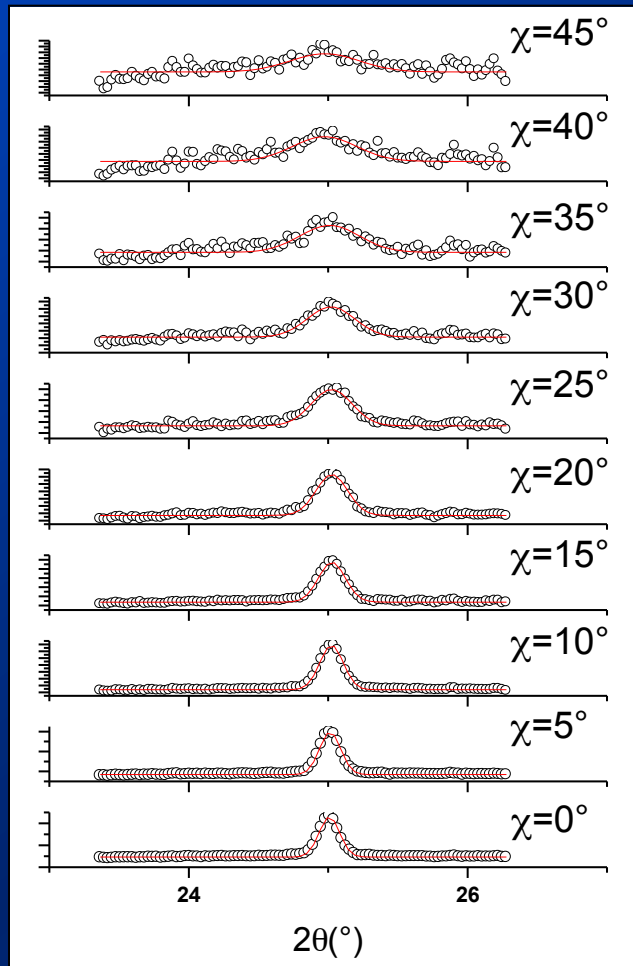
(m.r.d)

(003) peak for various χ angles



100% Powder

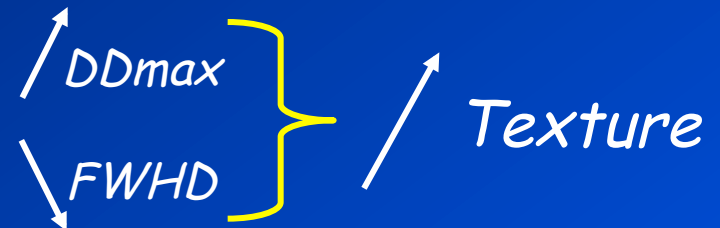
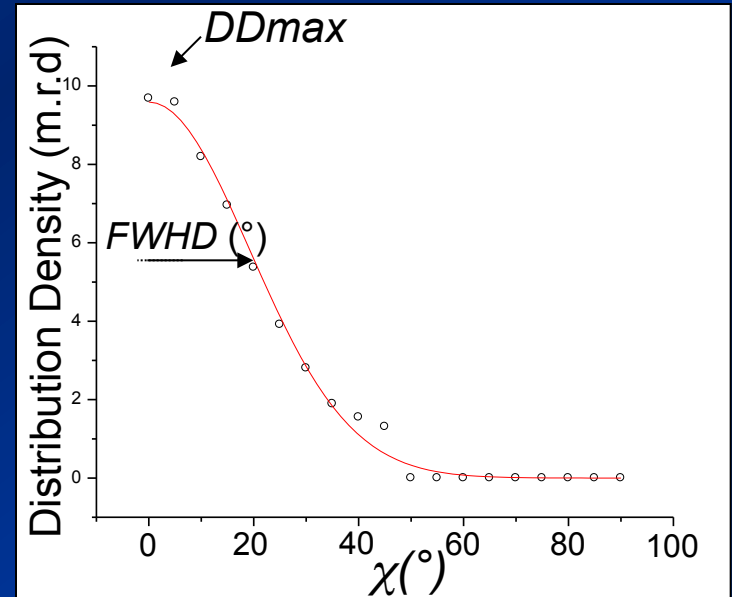
(003) Peak for various χ angles



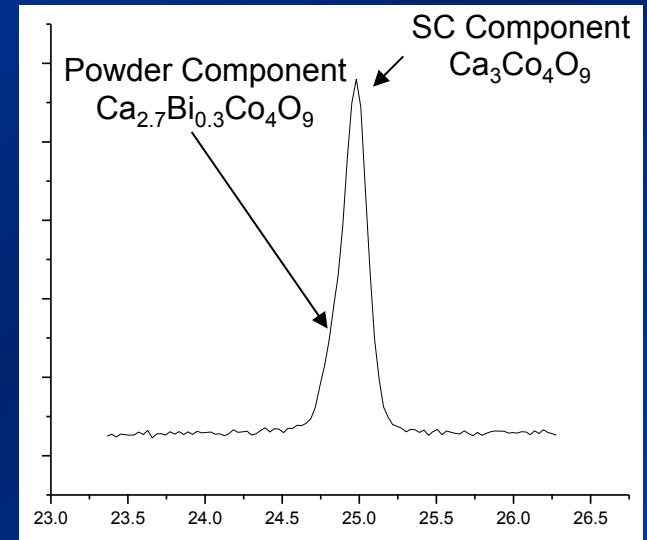
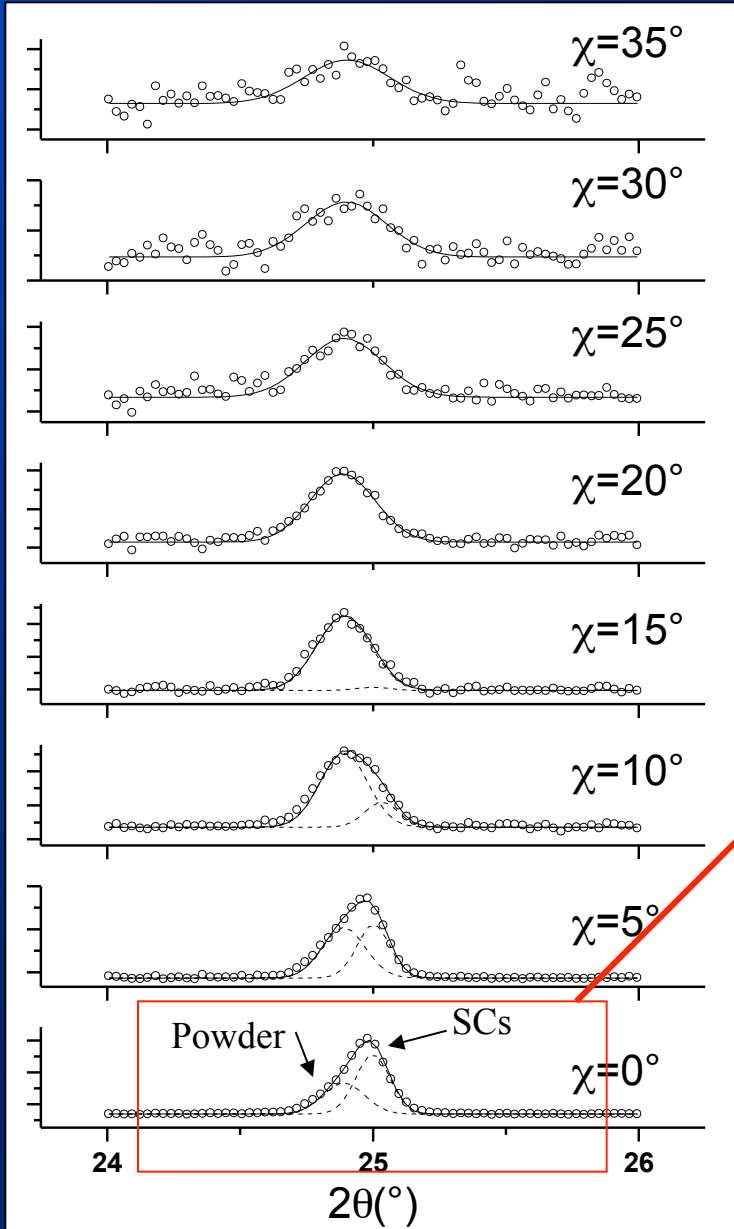
Integrated intensity $I_{003}(\chi)$

Normalisation

Distribution Density $D_{003}(\chi)$

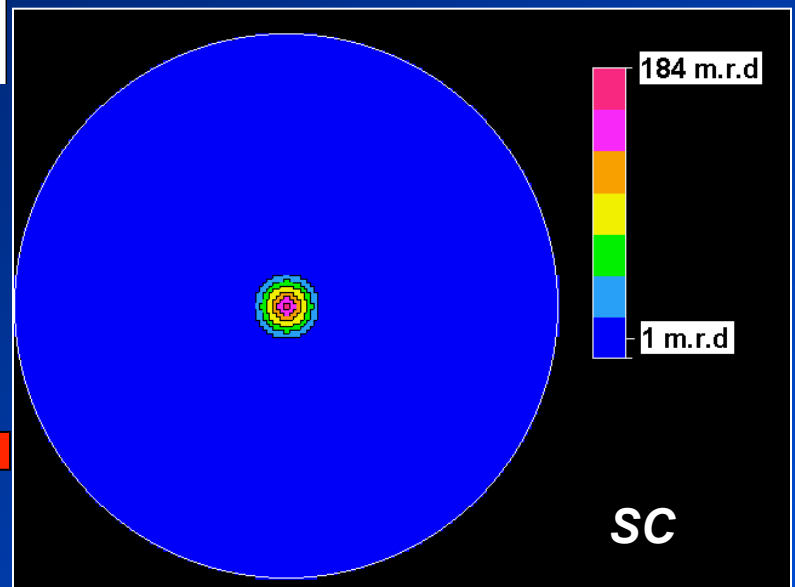
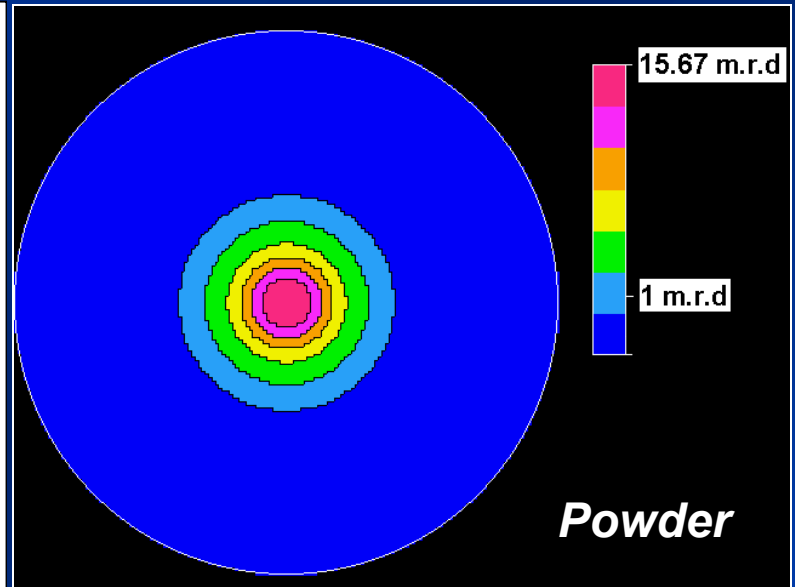
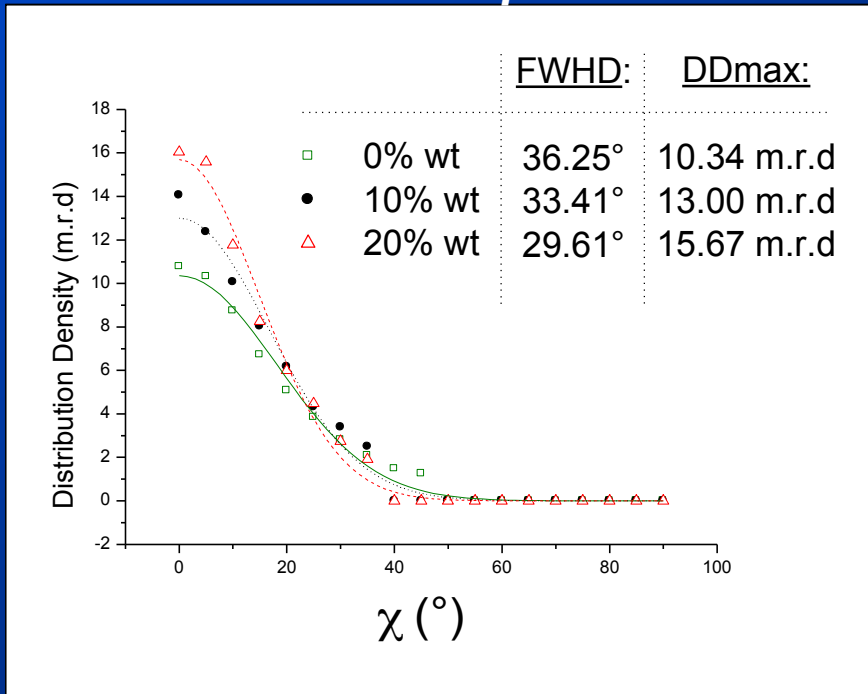


80% Powder / 20% SC



x	0	0.1	0.3	0.5
c (Å)	10.7407	10.7576	10.7834	10.7921

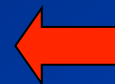
Powder Component



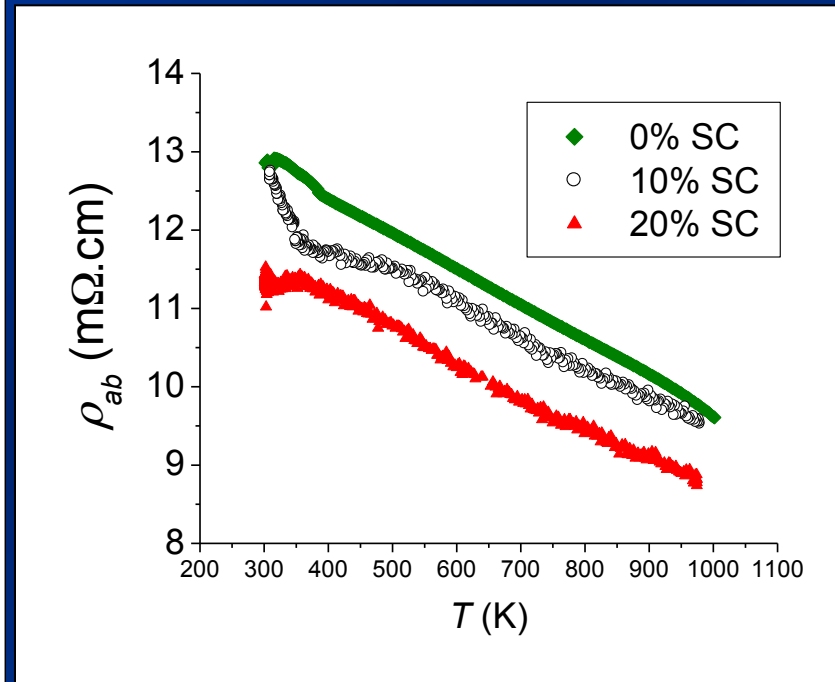
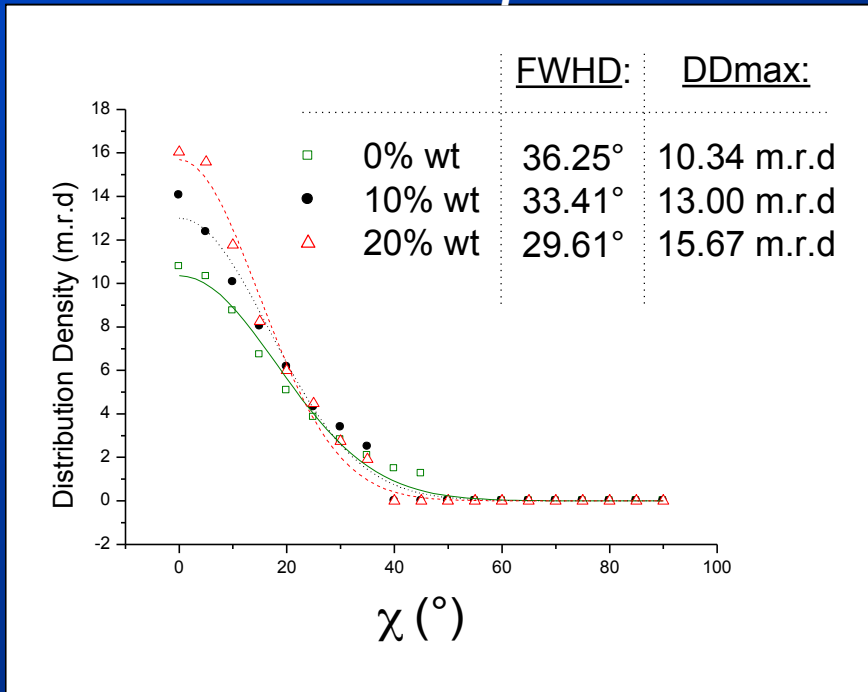
↗ %wt Single crystals

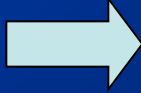


↗ Texture strength (Powder)



Powder Component



➤ Degree of orientation  Direct quantitative texture analysis

➤ Composite Materials : 2 texture components identified and quantified  SC  Powder

➤ *Texture ↔ TE properties Relationship*

➤ Analysis suitable for any materials where preferential orientations must be quantified