

LA-UR-16-29001

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Title:	Texture and phase analysis of deformed SUS304 by using HIPPO
Author(s):	Takajo, Shigehiro Vogel, Sven C.
Intended for:	To provide my supervisors in JFE Steel Corporation with my research activity in LANL
Issued:	2016-11-23

Disclaimer:

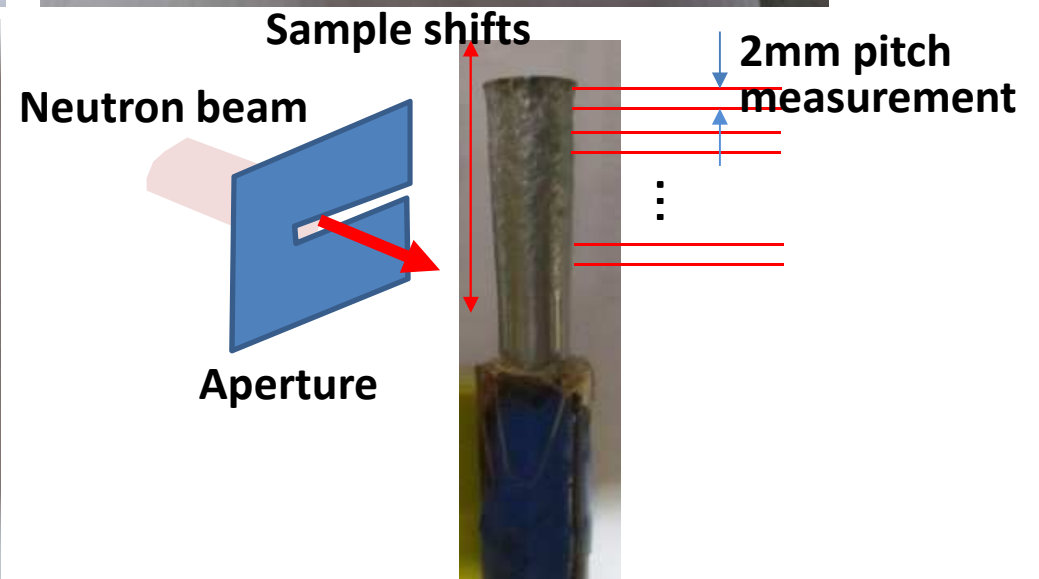
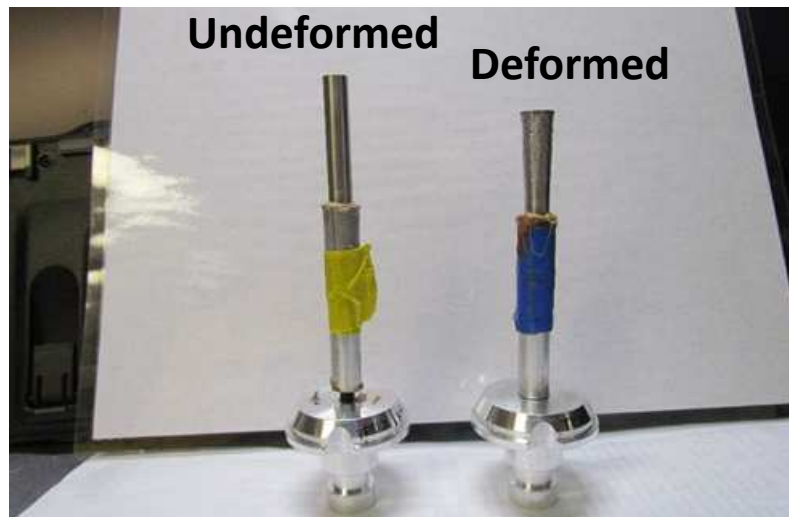
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Texture and phase analysis of deformed SUS304 by using HIPPO

Nov.15.2016

Sample: SUS304 (deformed and undeformed)

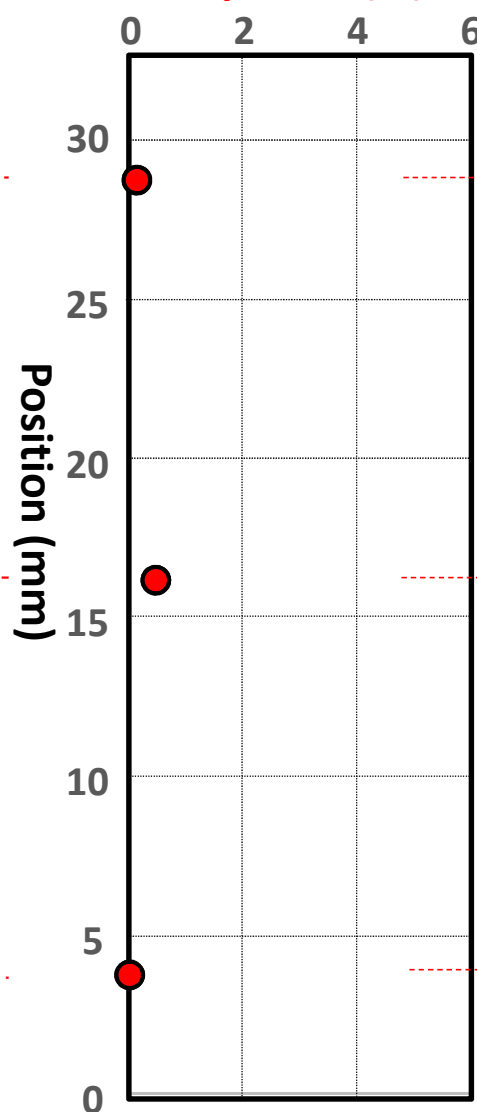
Owner: C Trujillo



Sample: SUS304
undeformed sample

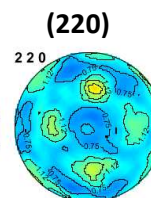
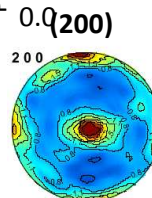
Nov.10.2016

Volume fraction
of α phase (%)



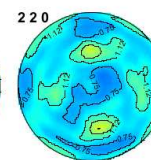
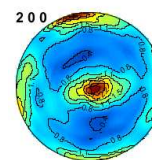
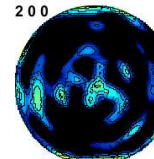
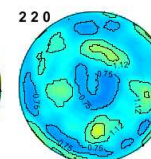
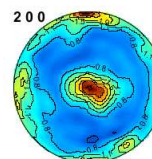
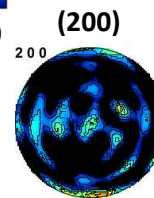
Probability (mrd)

γ phase



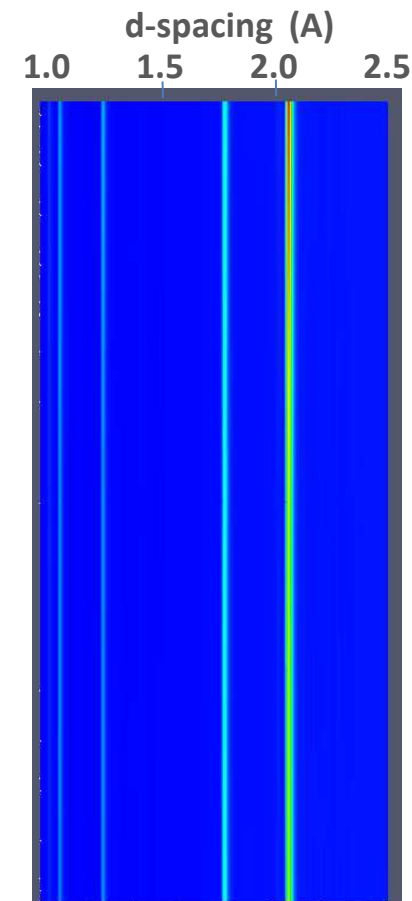
Probability (mrd)

α phase



No
 α -phase

Diffraction Intensity



MAUD
Analysis
conditions

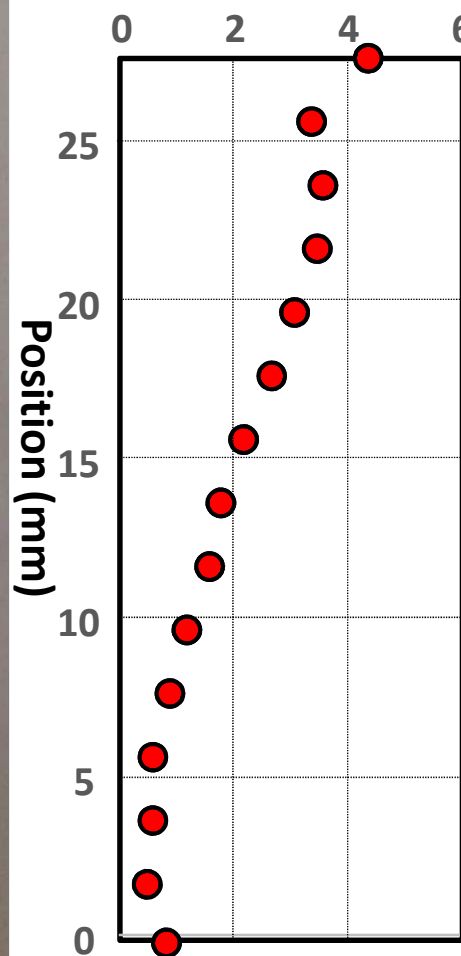
d range: 0.6-2.3 Å
Phase: α -Fe, γ -Fe
Microabsorption: neglected
Linebroadening model: Delft
Size strain model: **Isotropic**
E-WIMV, ODF resolution 7.5°

Sample: SUS304 deformed sample

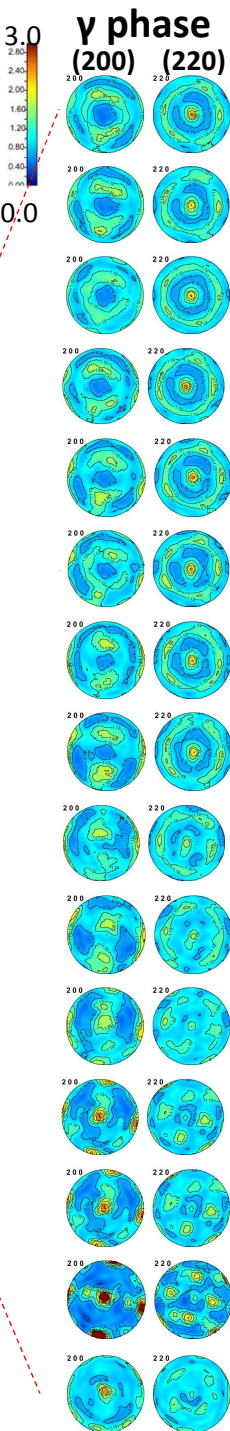
Nov.10.2016



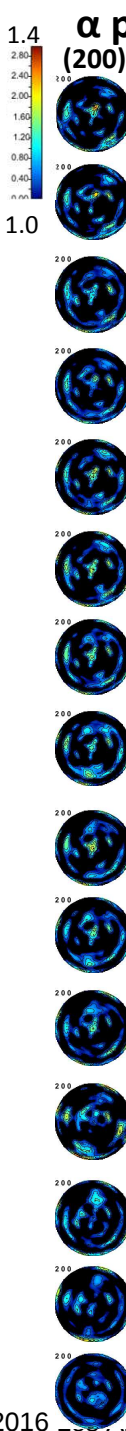
Volume fraction of α phase (%)



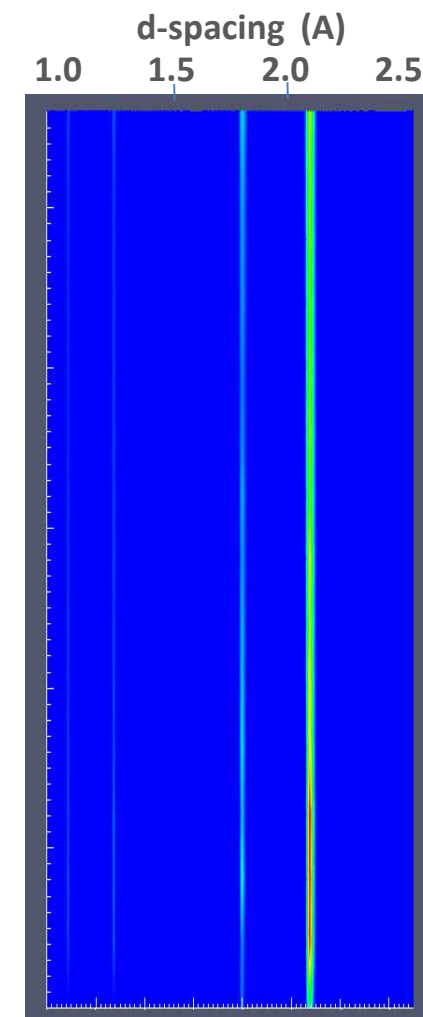
Probability (mrd)



Probability (mrd)



Diffraction Intensity



MAUD
Analysis
conditions

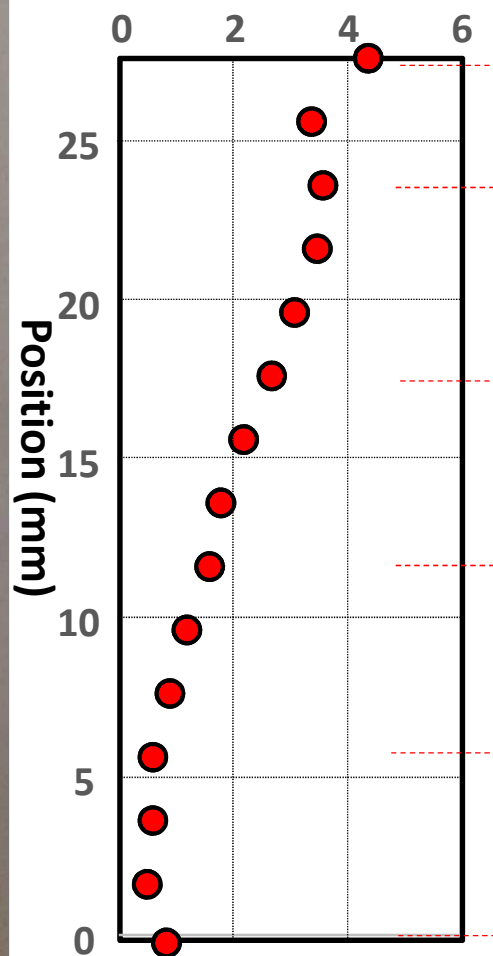
d range: 0.6-2.3 Å
Phase: α -Fe, γ -Fe
Microabsorption: neglected
Linebroadening model: Delft
Size strain model: Isotropic
E-WIMV, ODF resolution 7.5°

Sample: SUS304 deformed sample

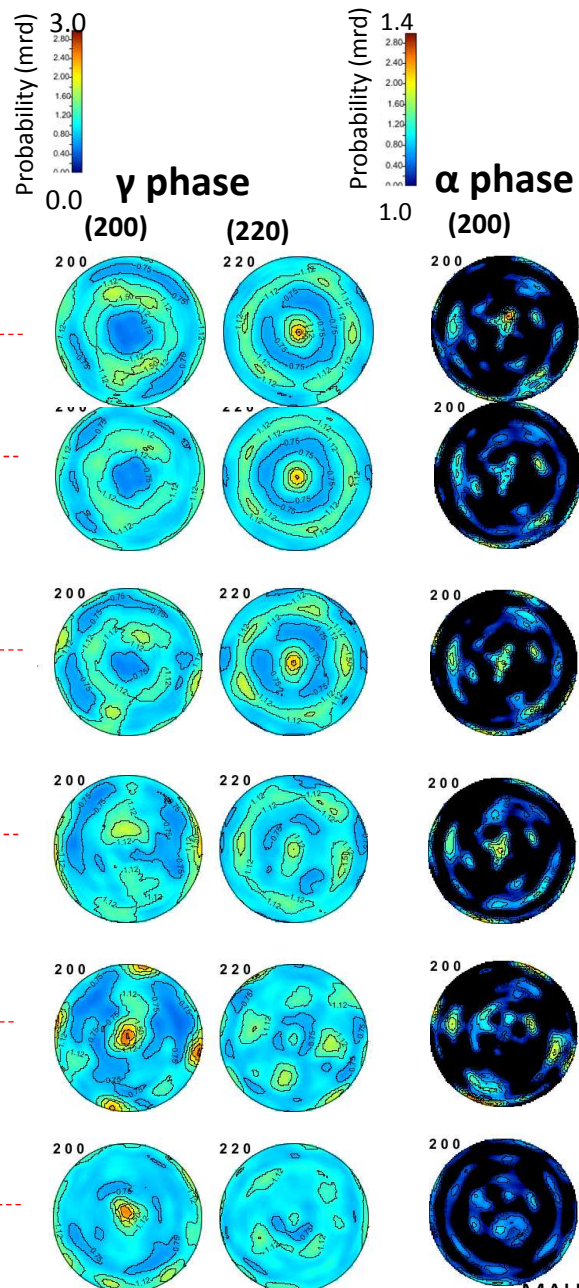
Nov.10.2016



Volume fraction of α phase (%)

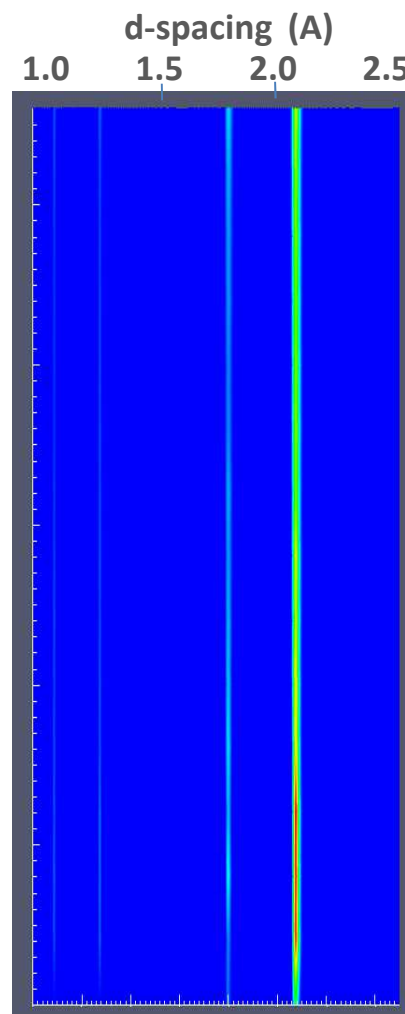


(200) of α -phase and (220) of γ -phase were developed by deformation



MAUD
Analysis
conditions

Diffraction Intensity



d range: 0.6-2.3 Å
Phase: α -Fe, γ -Fe
Microabsorption: neglected
Linebroadening model: Delft
Size strain model: **Isotropic**
E-WIMV, ODF resolution 7.5 °

Diffraction histogram at each sample position

Bank90 data

severe

deformation

Def_094

Def_092

Def_090

Def_088

Def_086

Def_084

Def_082

Def_080

Def_078

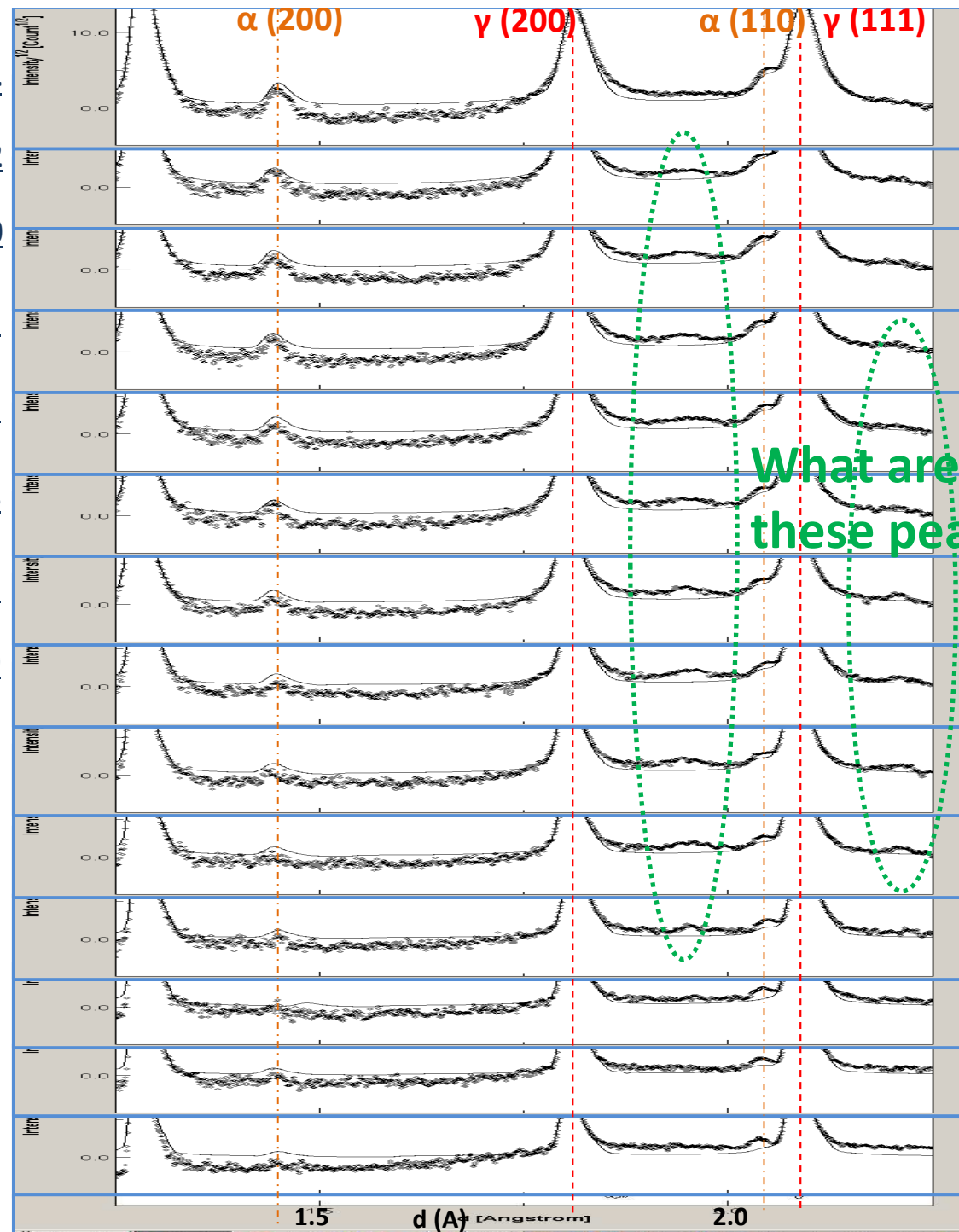
Def_076

Def_074

Def_072

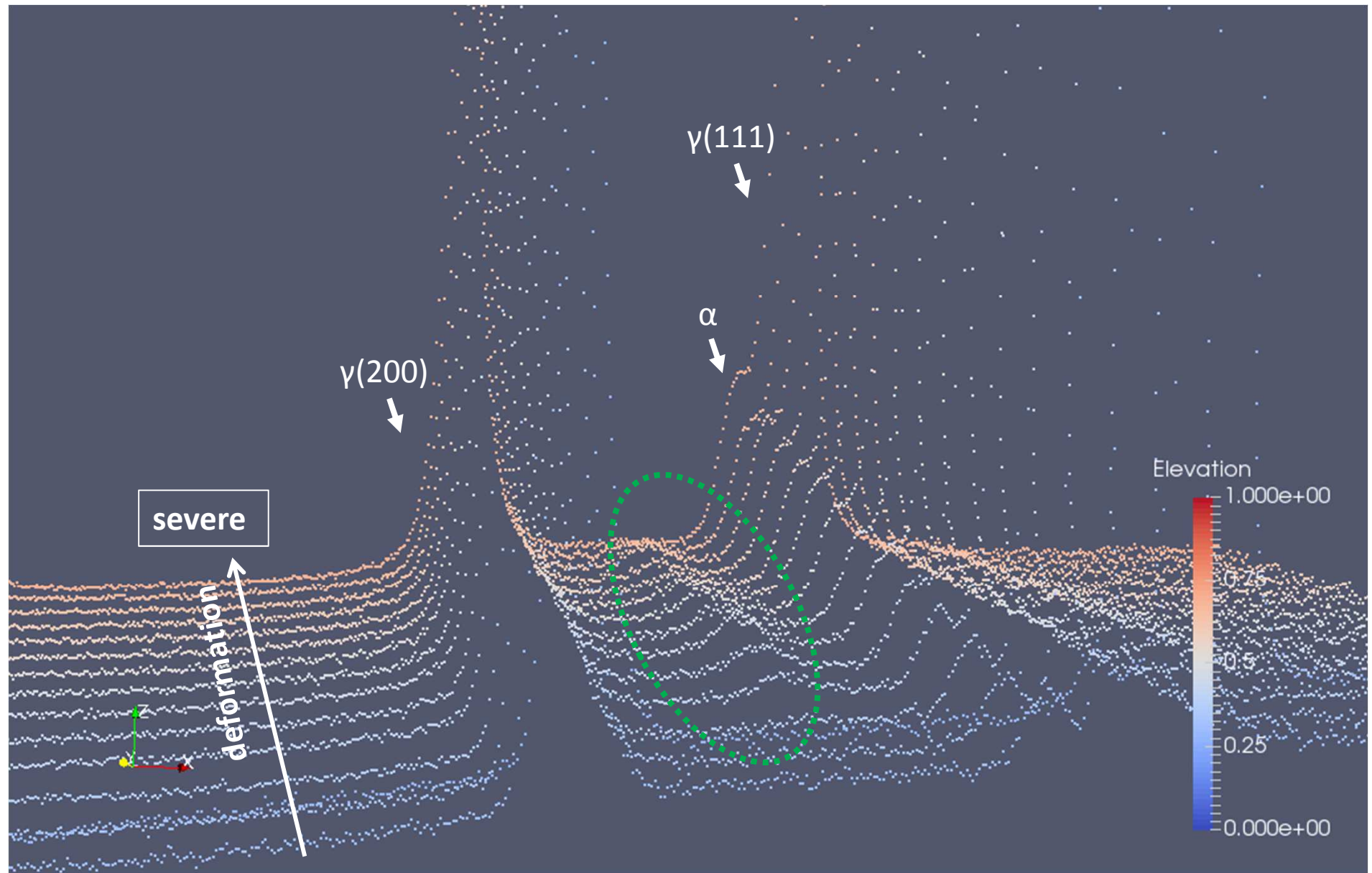
Def_070

Def_068

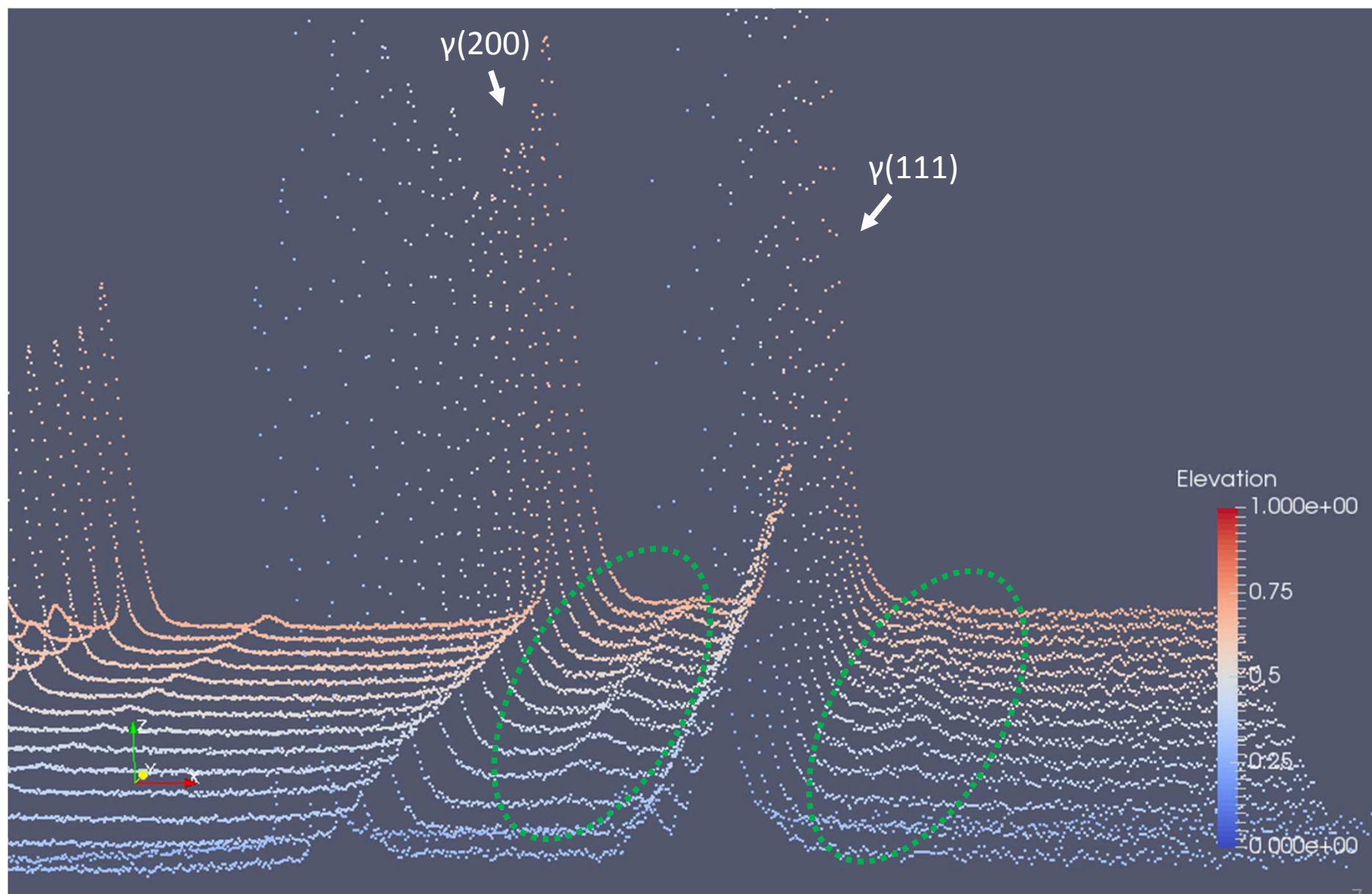


What are
these peaks?

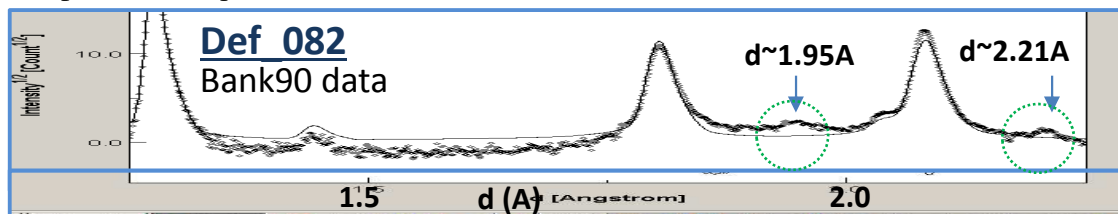
Diffraction histogram (all bank data averaged)



Diffraction histogram (all bank data averaged)

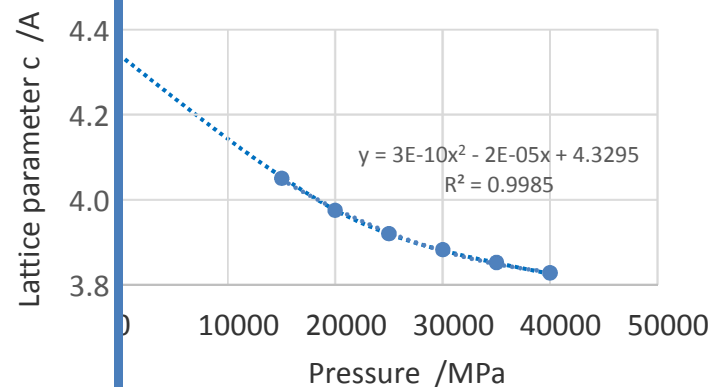
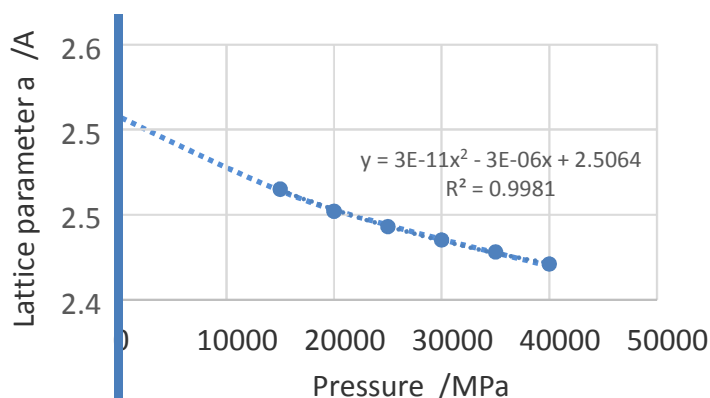


Possibility of ϵ -phase



The only lattice information of ϵ -phase was measured at high pressure state

J. Phys. Chem Solids Pergamon Press 1964. Vol. 25, pp. 865-868.



Ambient
(0.1 Mpa)

Lattice parameter at ambient pressure was estimated by extrapolation of the high-pressure data

$a \rightarrow 2.51 \text{ Å}$
 $c \rightarrow 4.33 \text{ Å}$



Estimated d value of ϵ -phase at ambient pressure

$d_{100} \rightarrow 2.17 \text{ Å}$
 $d_{002} \rightarrow 2.17 \text{ Å}$
 $d_{101} \rightarrow 1.94 \text{ Å}$

Recent reference

PHILOSOPHICAL MAGAZINE LETTERS, 2016
VOL. 96, NO. 6, 220–227

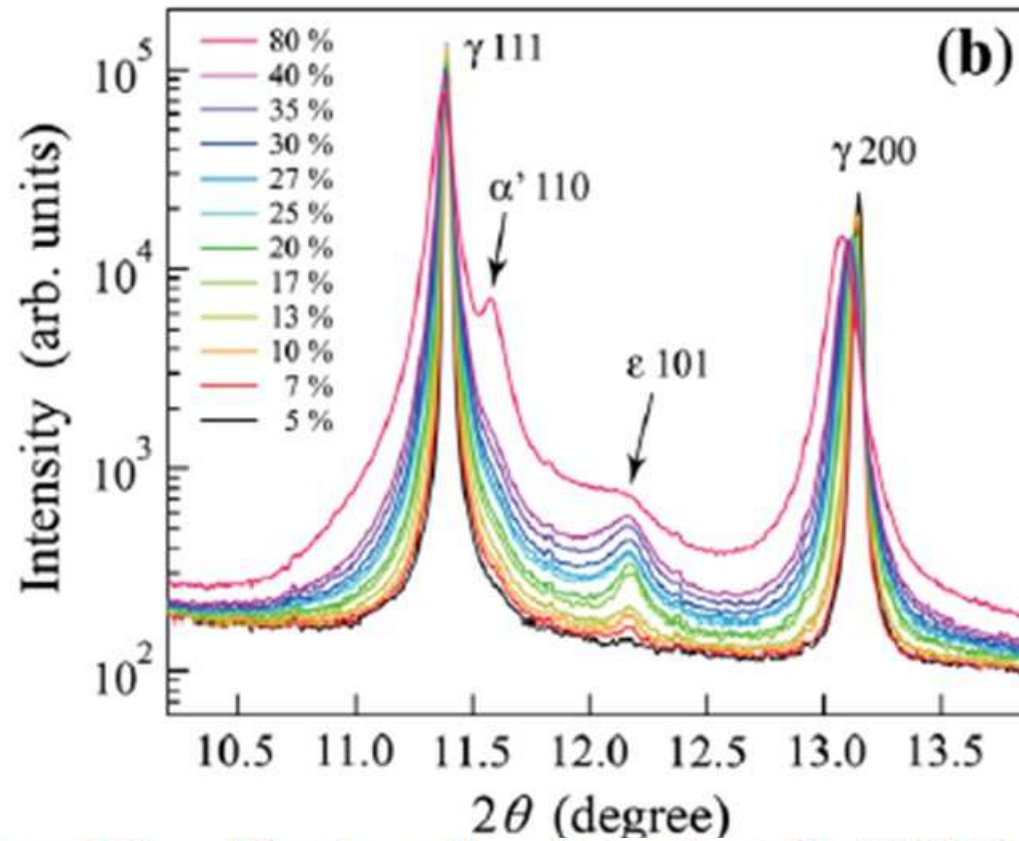
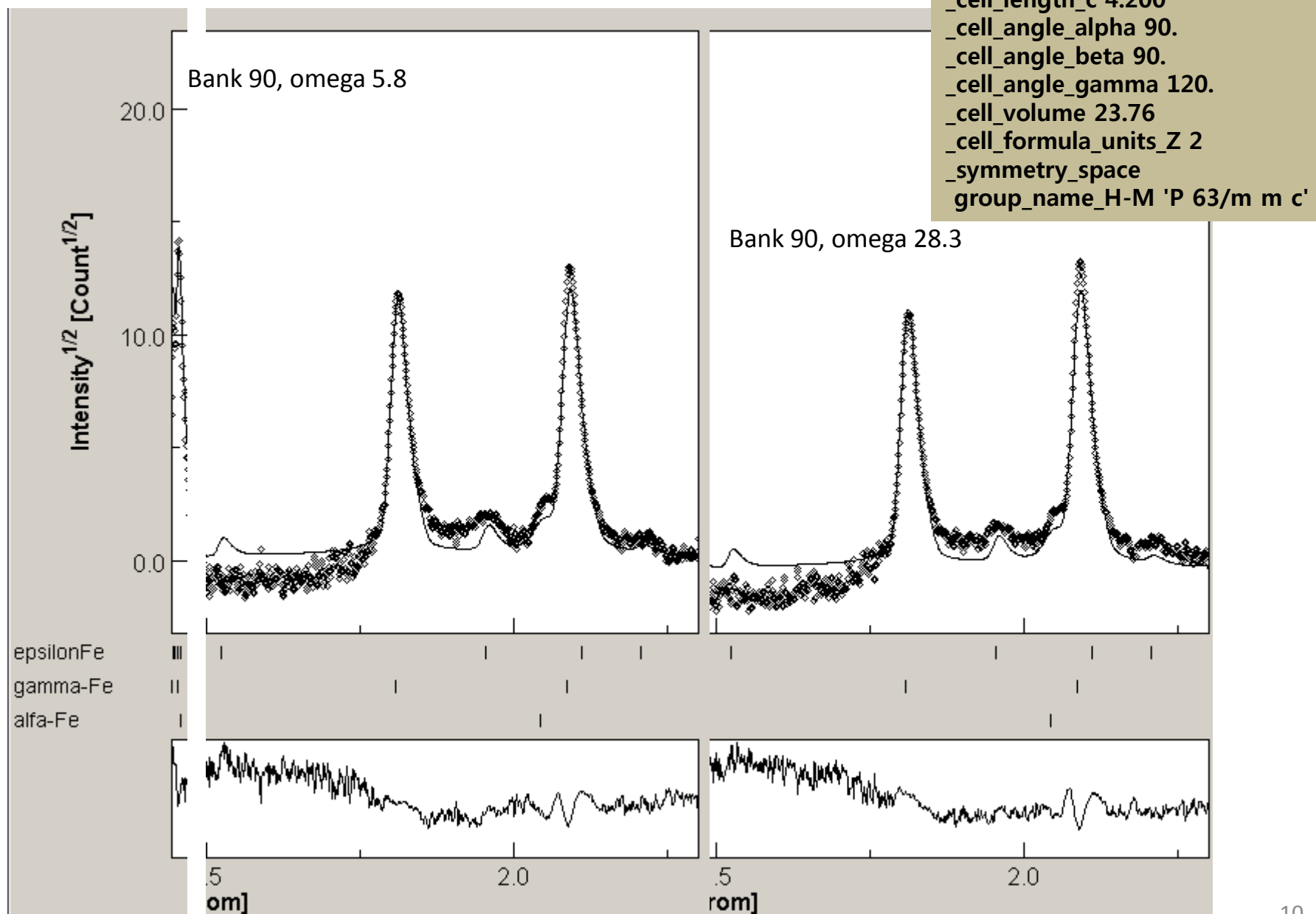


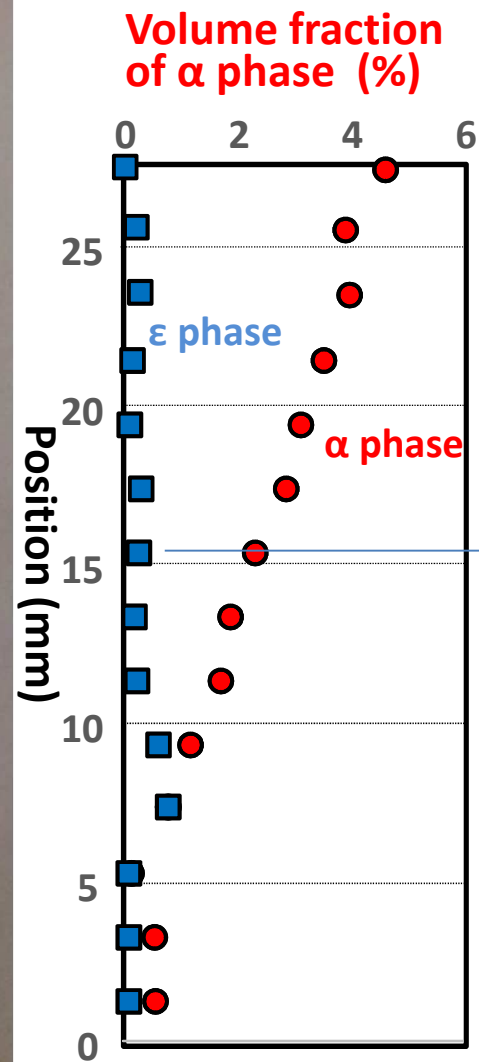
Figure 2. X-ray diffraction patterns for tensile strained SUS304 specimens.

MAUD analysis with Including ϵ -phase

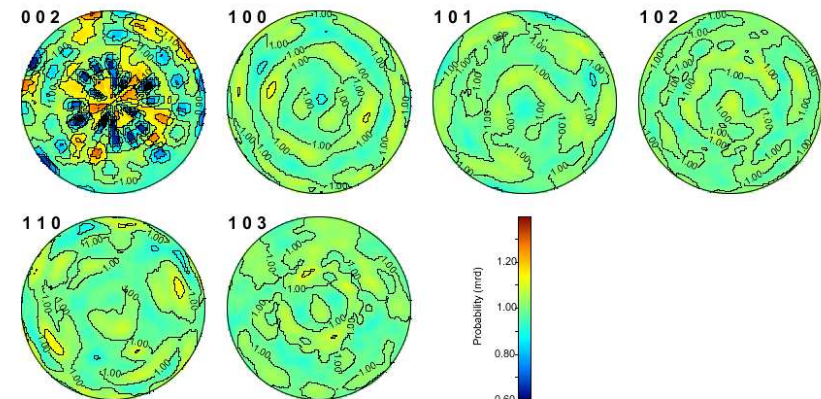


Sample: SUS304 deformed sample

Texture analysis iteration 3,
Initial set values; α 2%, ϵ 2%



Not good precision ?
EBSD could be useful



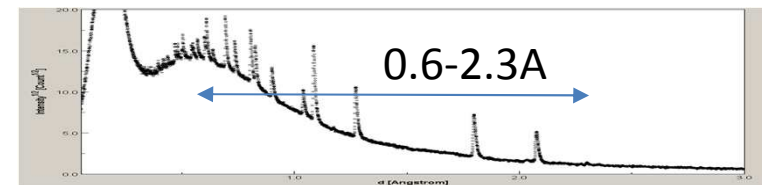
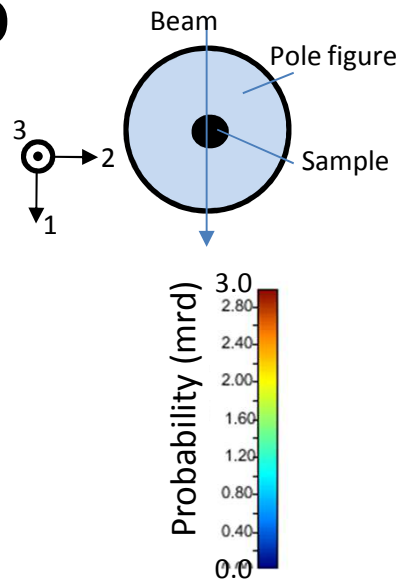
Supplementary

Pole figure by MAUD

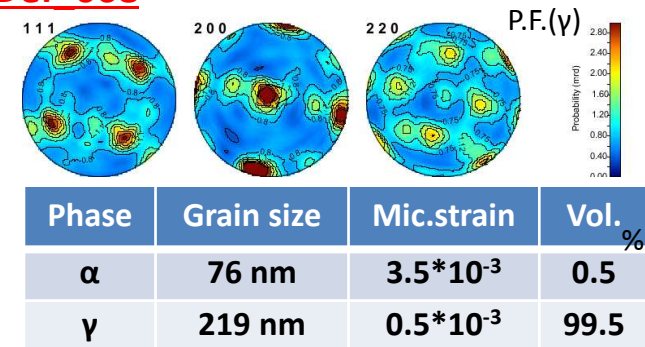
Sample: SUS304

Owner: C Trujillo

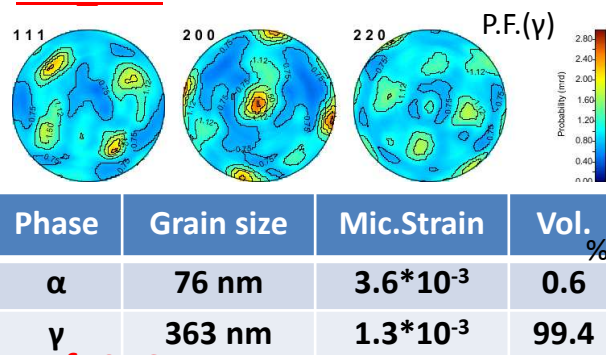
d range: 0.6-2.3 Å
 Phase: α -Fe, γ -Fe
 Microabsorption: neglected
 Linebroadening model: Delft
 Size strain model: **Isotropic**
 Sample position: χ -90°
 E-WIMV, ODF resolution 7.5 °



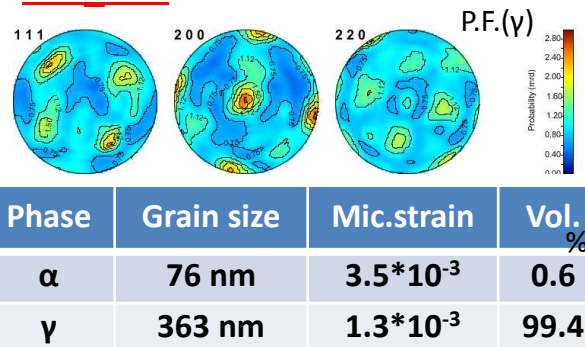
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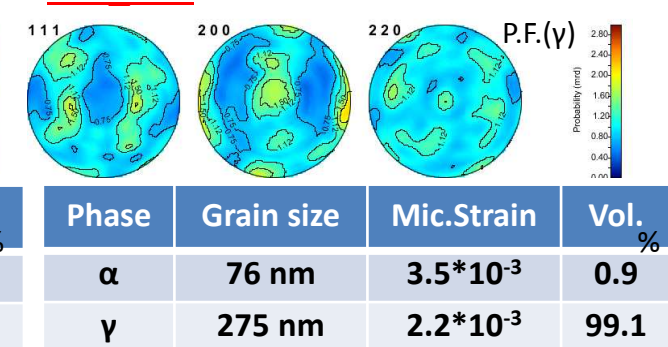
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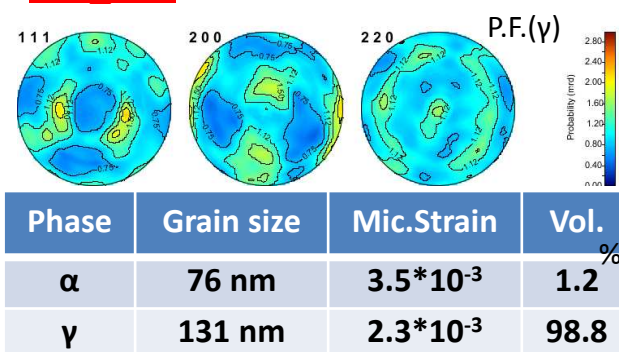
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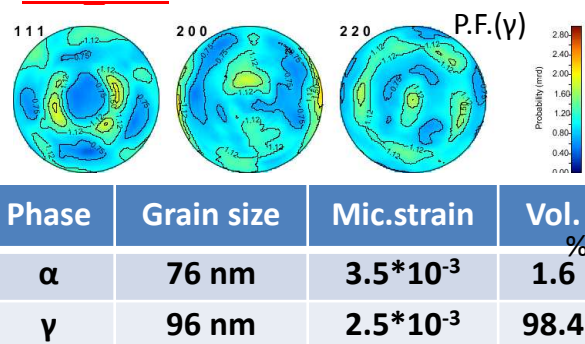
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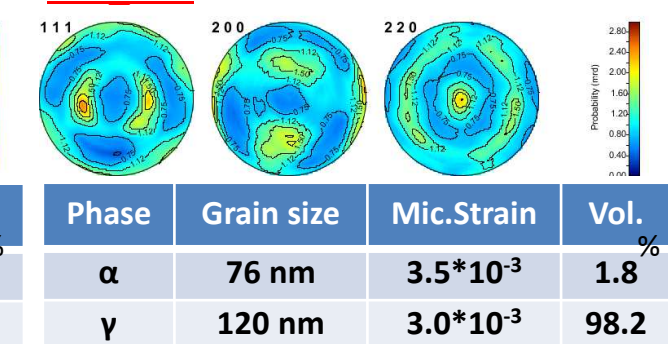
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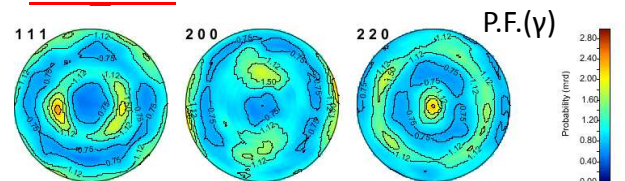
Def 078



Def 080

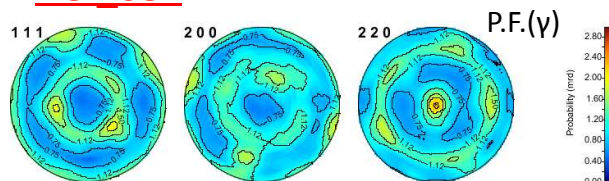


Def_082



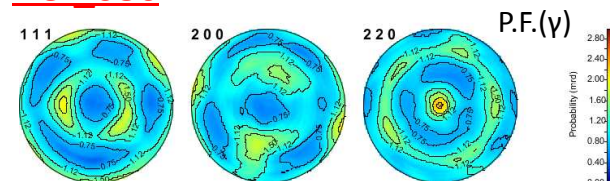
Phase	Grain size	Mic.Strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	2.2
γ	74 nm	$2.9 \cdot 10^{-3}$	97.8

Def_084



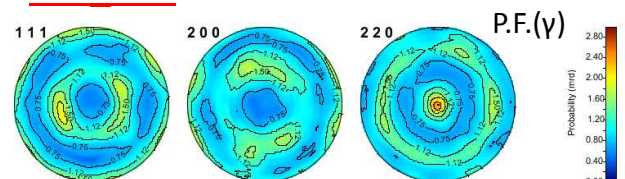
Phase	Grain size	Mic.strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	2.7
γ	69 nm	$3.1 \cdot 10^{-3}$	97.3

Def_086



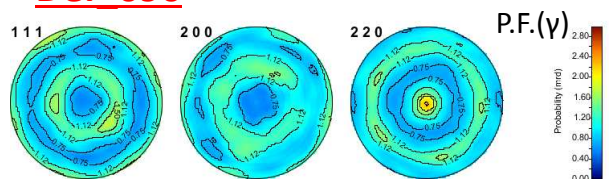
Phase	Grain size	Mic.Strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	3.1
γ	85 nm	$3.5 \cdot 10^{-3}$	96.9

Def_088



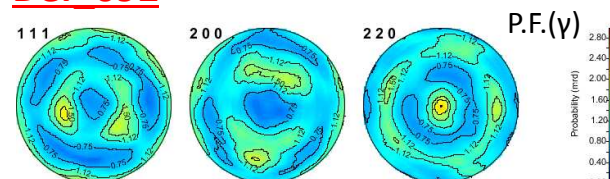
Phase	Grain size	Mic.Strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	3.5
γ	61 nm	$3.3 \cdot 10^{-3}$	96.5

Def_090



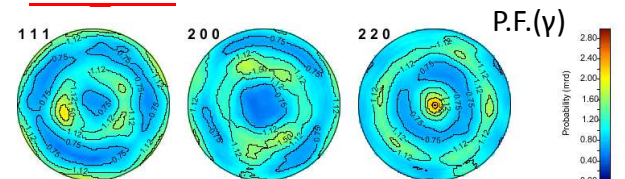
Phase	Grain size	Mic.strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	3.6
γ	61 nm	$3.4 \cdot 10^{-3}$	96.4

Def_092



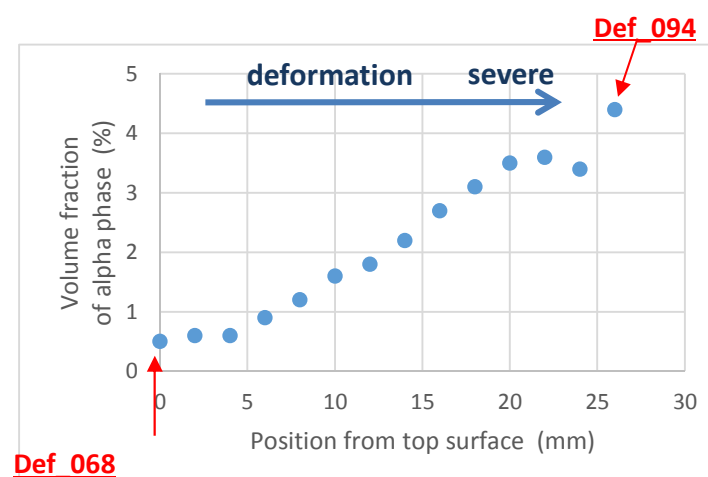
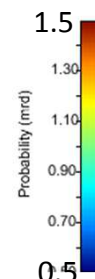
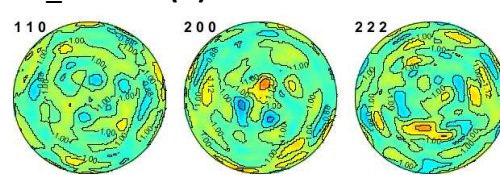
Phase	Grain size	Mic.Strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	3.4
γ	42 nm	$2.8 \cdot 10^{-3}$	96.6

Def_094



Phase	Grain size	Mic.Strain	Vol. %
α	76 nm	$3.5 \cdot 10^{-3}$	4.4
γ	63 nm	$3.7 \cdot 10^{-3}$	95.6

Def_094 P.F.(α)

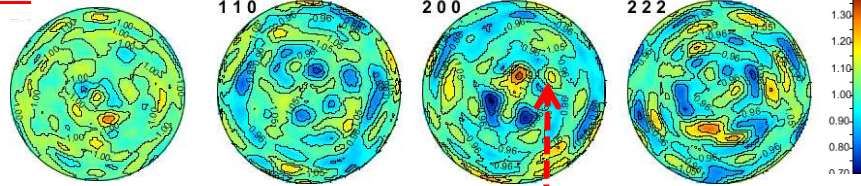


Texture

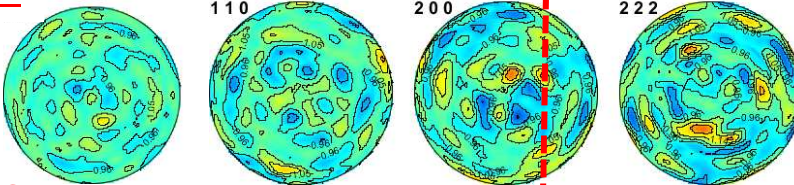
α -Fe

γ -Fe

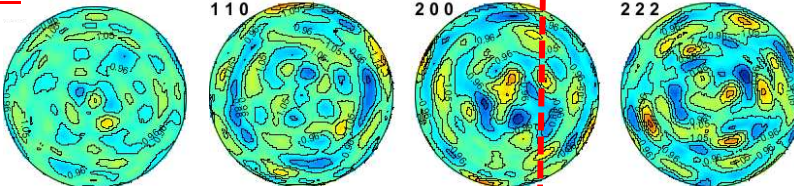
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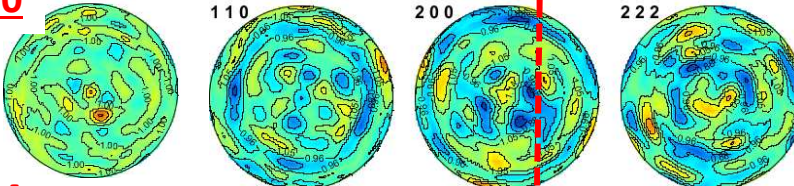
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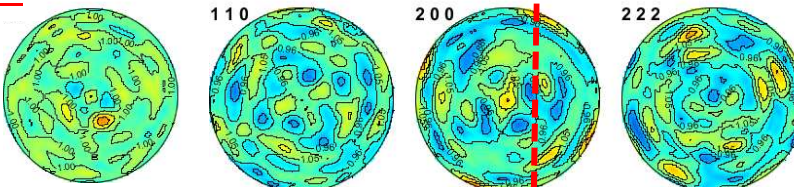
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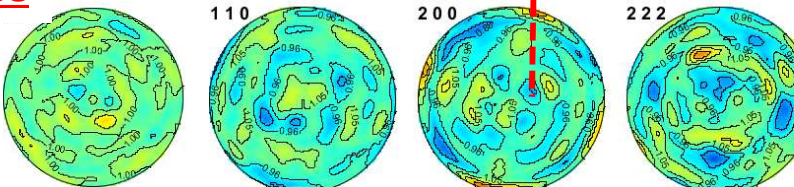
Def 080



Def 074



Def 068



severe

deformation

