Homogenization of Nb Microstructures

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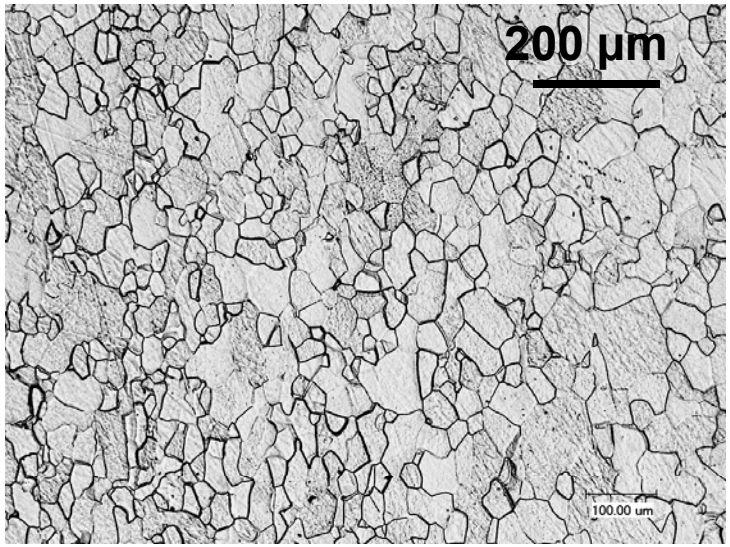
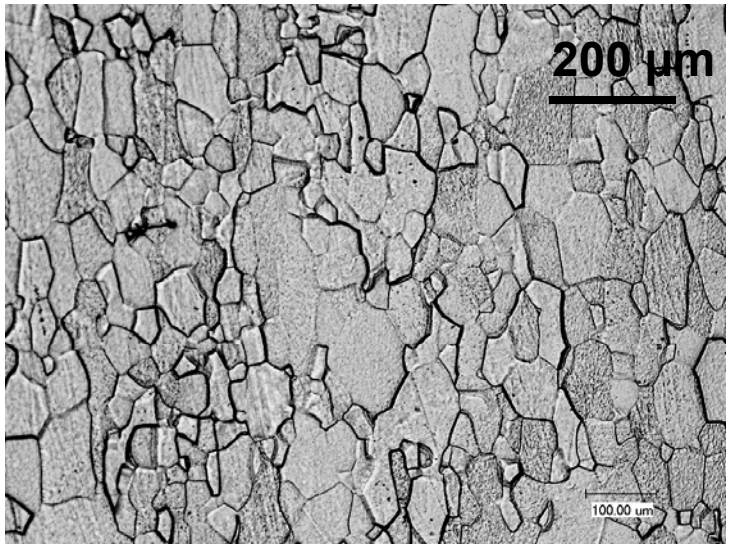
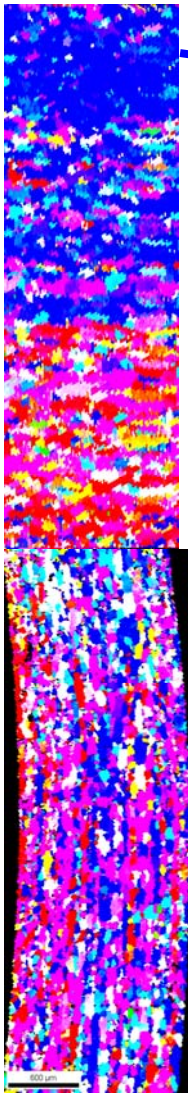
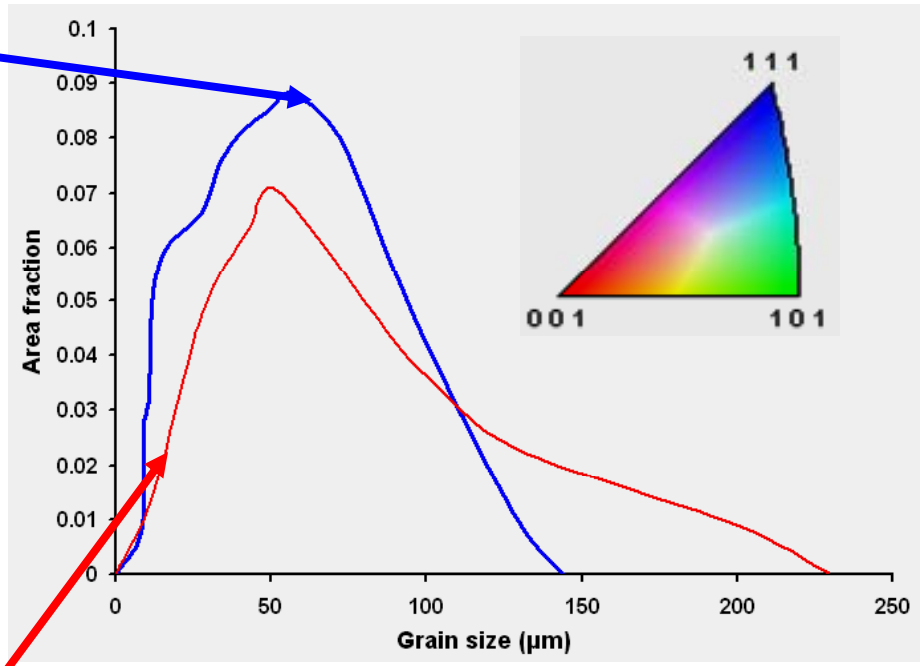
Problem







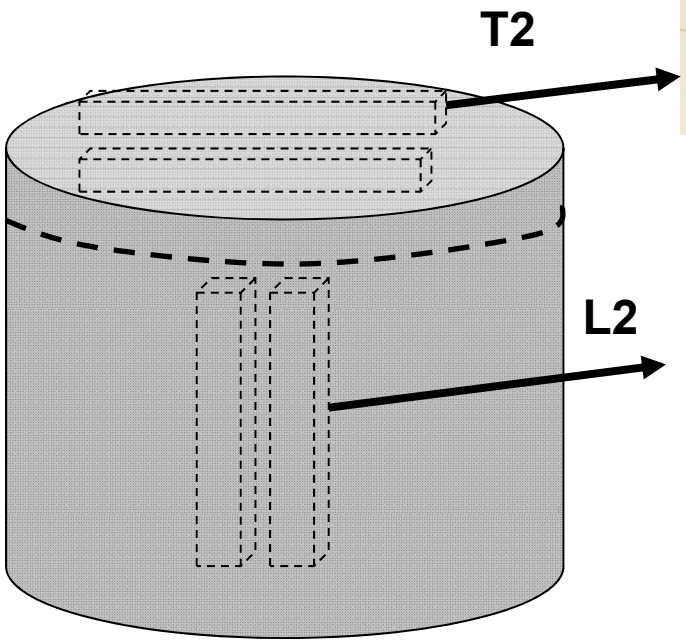


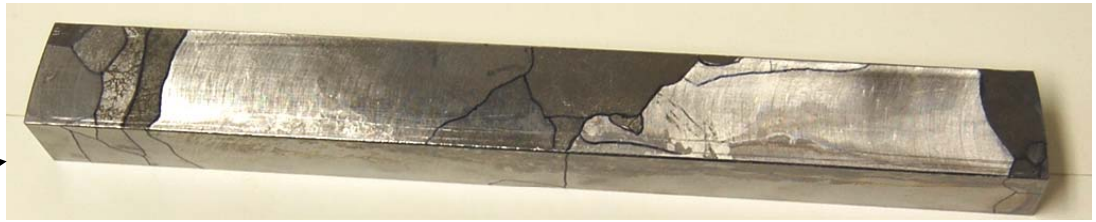
100 mm

Need: To obtain consistent starting microstructures.

Hypothesis and Experimental Procedure

- Severe plastic deformation and heat treatments can transform different starting microstructures in bulk Nb to the same final microstructure.

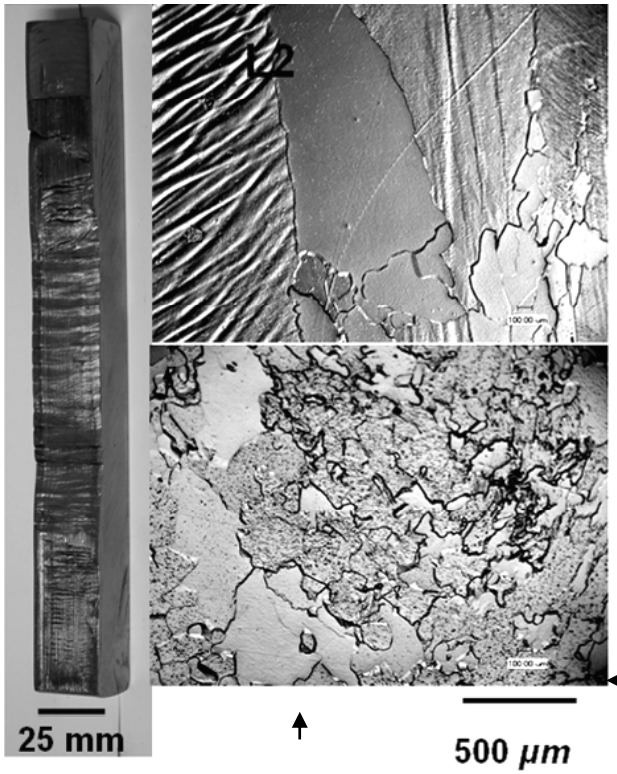




25mm

25mm

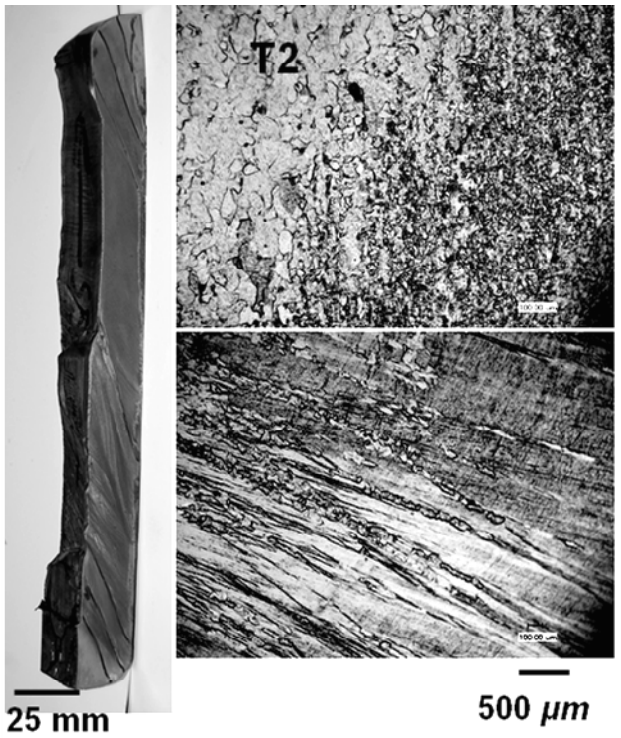
Results

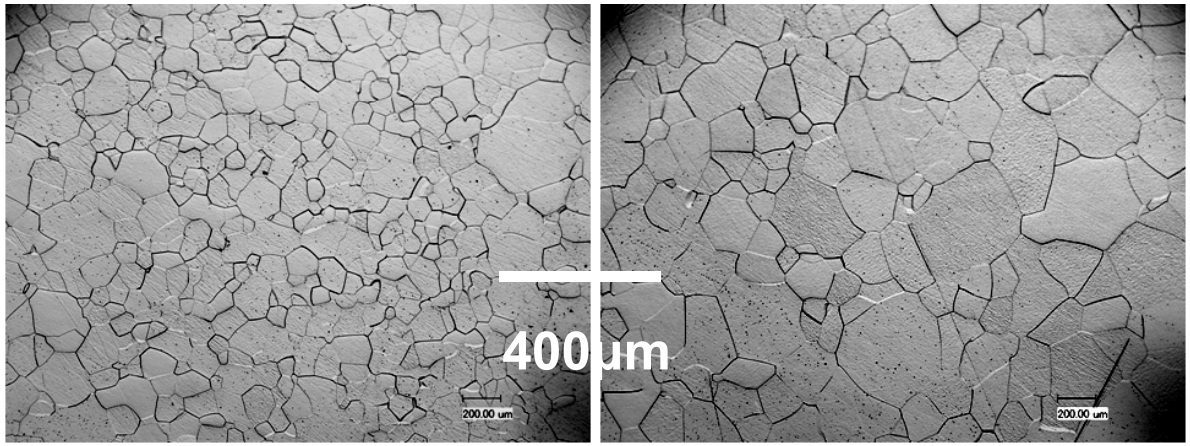


After 2 passes ECAE and
Heat Treatment of 1100°C

L2

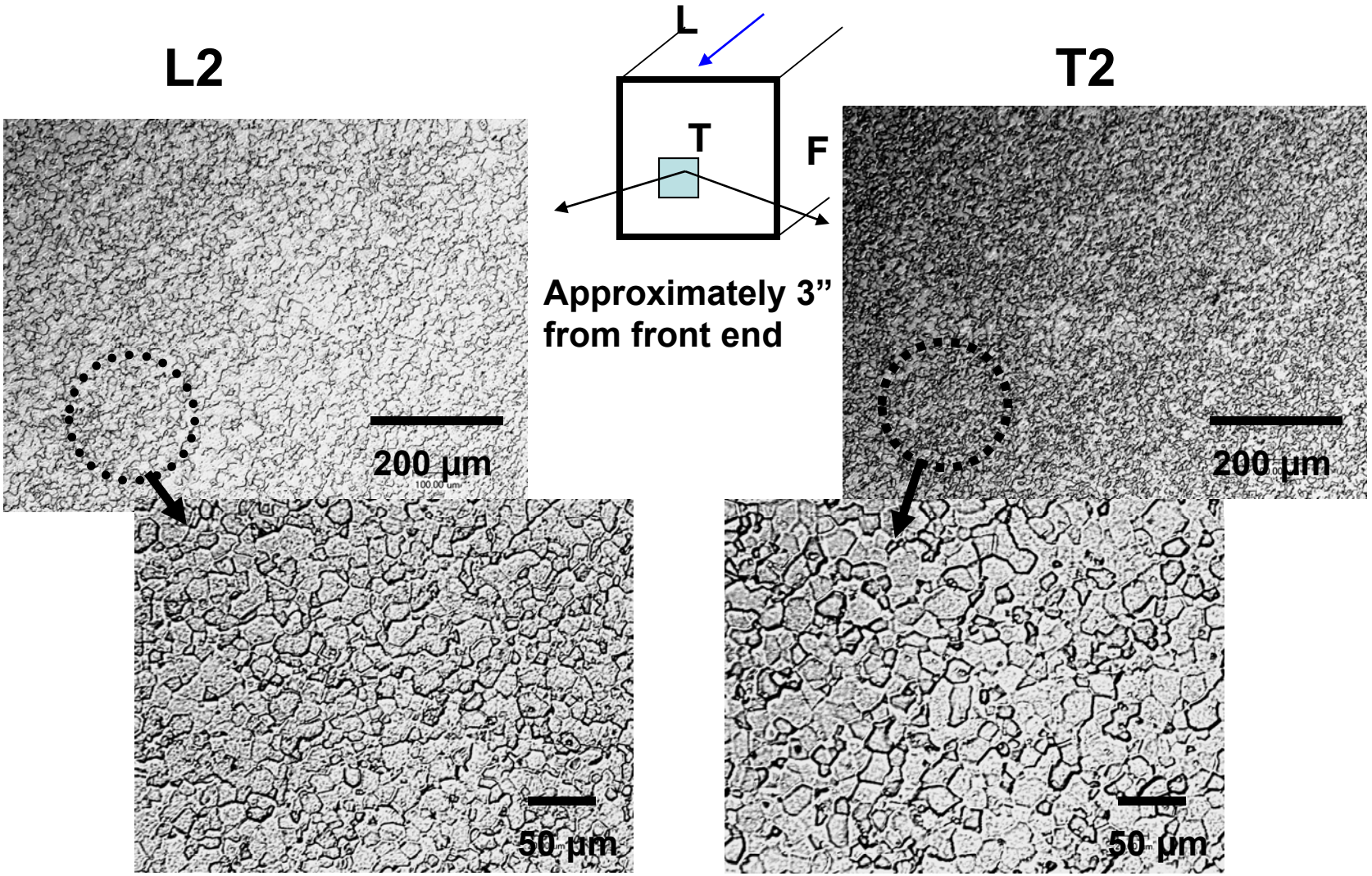
T2



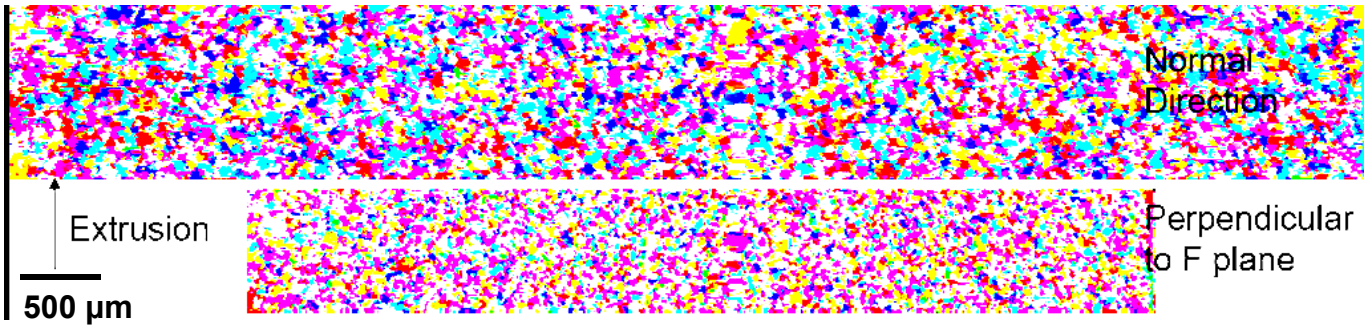


After 6 passes ECAE and Heat Treatment of 1250°C

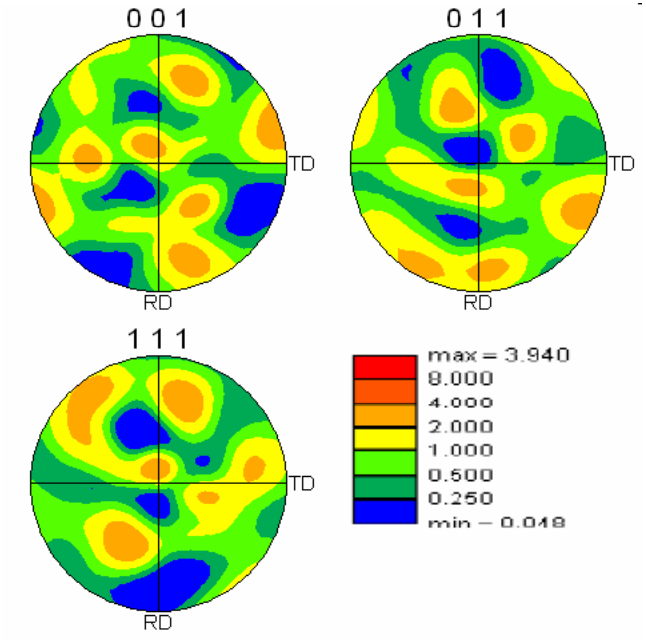
Encouraging Finding

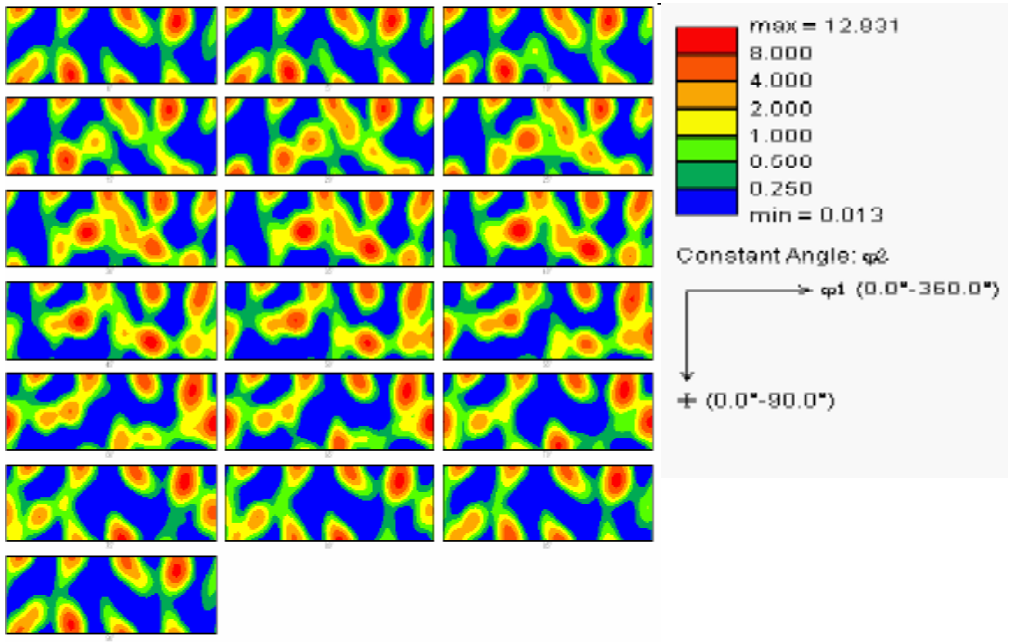


Expected Texture (Prior Result)



D.Baars, T.R.Bieler





Conclusions

- A specific series of SPD plus recrystallization heat treatment steps is effective for microstructural breakdown and convergence to a specific final microstructure.
- Will it work for RRR Nb? Why not.
- **Will it lead to worsening of the hydrogen problem?**
- Is it possible to scale up ECAE? We shall see…
- Will ECAE be sufficiently cost effective for commercialization? – Only if ECAE meets the challenge more easily than competing technologies.
- Where do we go from here? Bulk material could be used to make consistent Nb sheet.

Acknowledgements

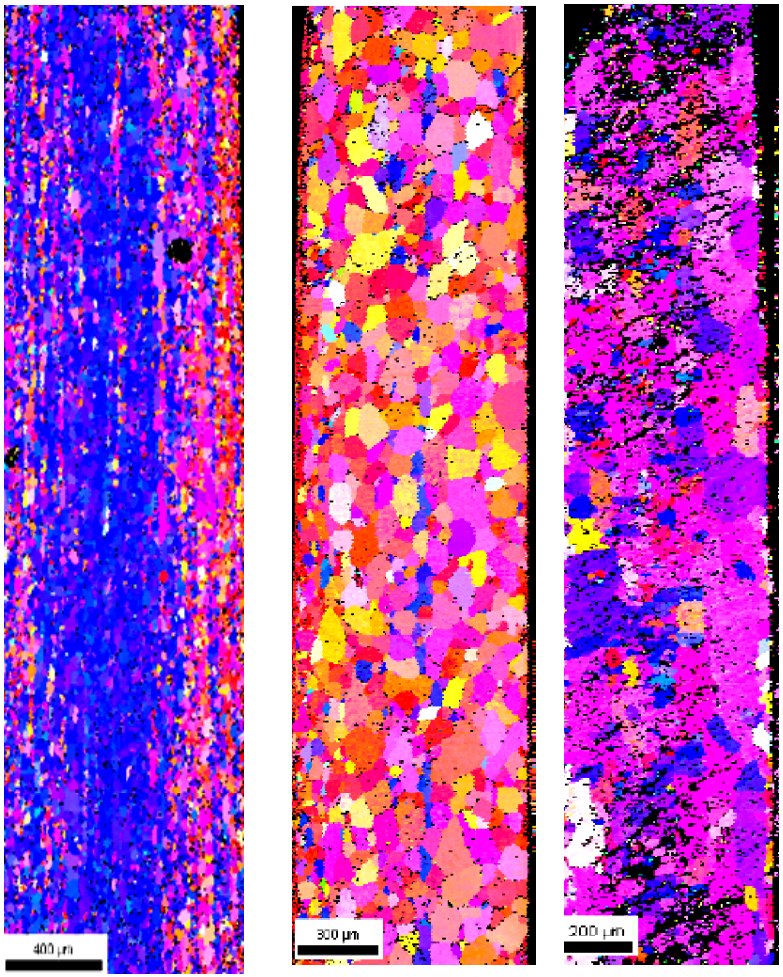
- Larry Jones, AMES Lab
- Douglas Krebs and Roston Elwell, Dept of Mechanical Engineering,TAMU.

Thank you for your attention

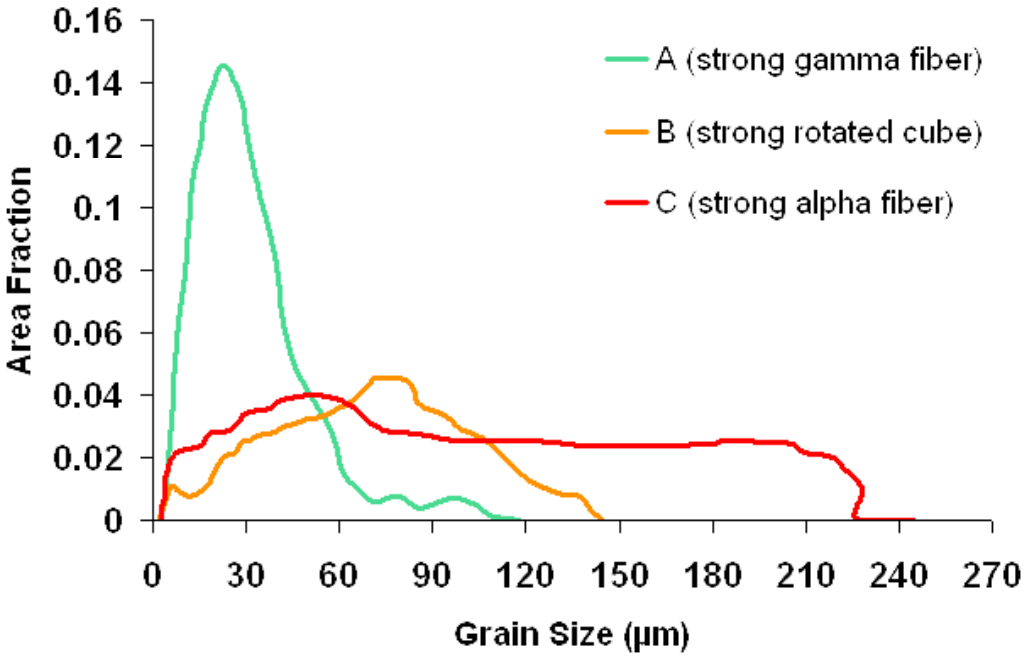
Comments and Questions?

EXTRAS

Grain size and Texture



A B C



Fine grain sizes obtained.

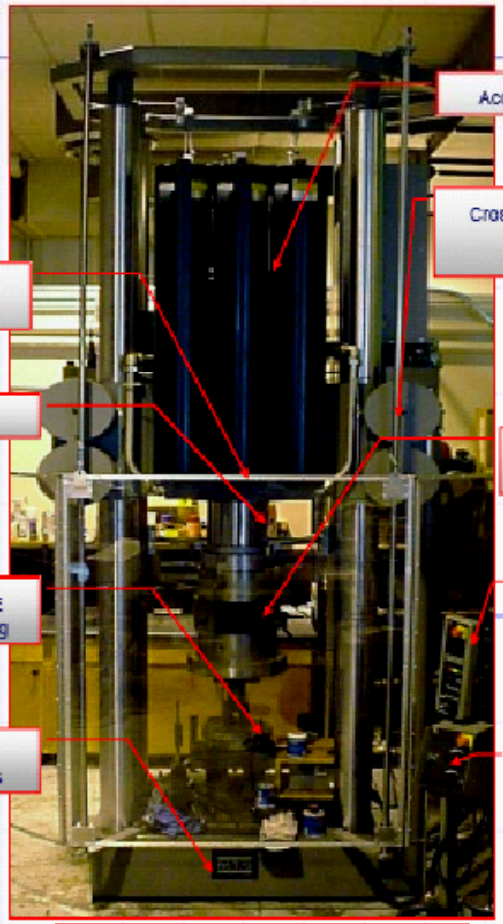
Ratios of textural components directly related to processing.

EXTRAS

The ECAE Research Group

Department of Mechanical Engineering
Texas A&M University

Press Facilities*



MTS Load Frame

Load Frame Specifications

- Load capacity.....570.8 kip (2539 kN)
- Stroke.....20 in (50.8 cm)
- Ram Dia.....13.5 inches
- Cyl. Dia.....20.6 inches
- Effective Area.....190.26 sq. inches
- Base platens width.....44 inches
- Base platens depth.....36 inches
- Workspace.....20x30x78in (50.8x76x198cm)
- Maximum Speed.....2.5 $^{in}/_{s}$ (6.35 $^{cm}/_{s}$)
- Crosshead mounted cylinder
- Hydraulically moved and locked cross head
- Three hydraulic accumulators for full force fast extrusions

***Acquired by AFOSR/DURIP Contract**

Claim

- Starting Microstructures.
- Conventional processing steps do not effectively breakdown the initial microstructure.
- Unfavorable initial microstructures lead to undesirable results at later stages.

Need: To obtain consistent starting microstructures.