

Water Erosion Resistant Surface Treatments Using Low Plasticity Burnishing

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Outline

- ▶ Review
- ▶ Correlation between micro hardness and residual stress
- ▶ Residual stress measurement
- ▶ LPB high speed coupon preparation
- ▶ Timeline for the end of the project

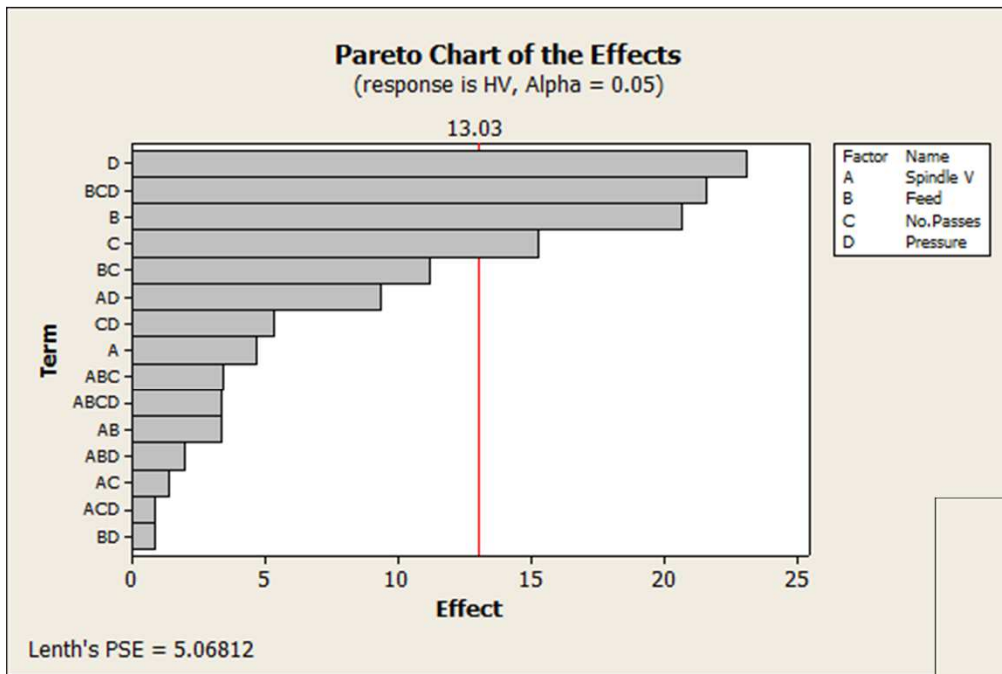




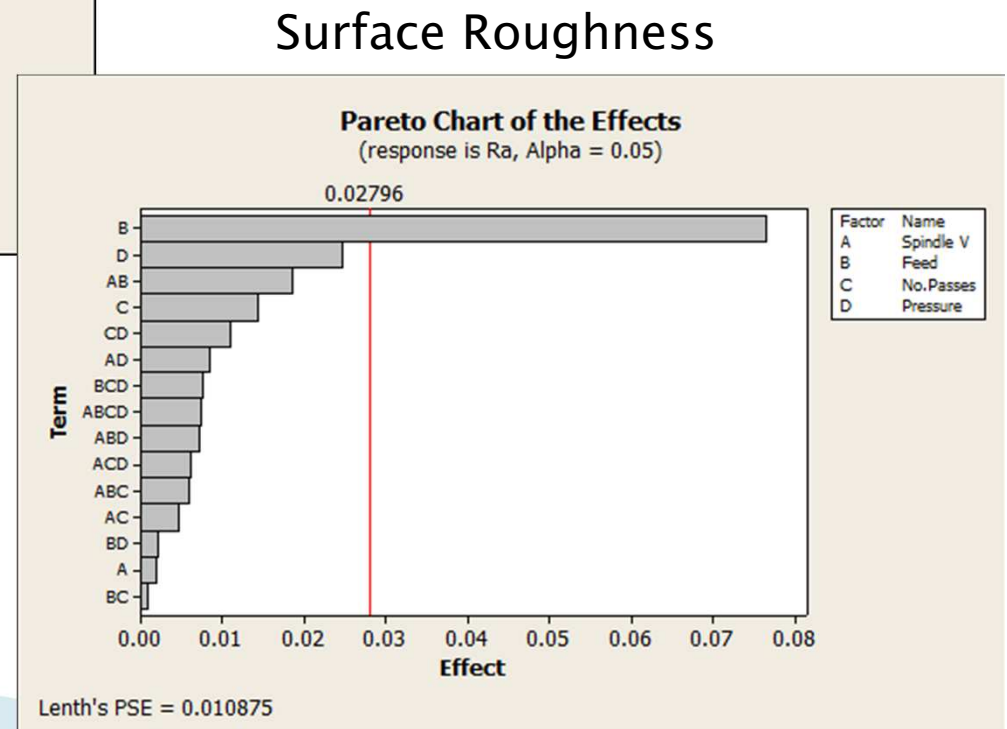
Review



DOE for LPB



Surface Hardness
(Load: 50g Time: 15secs)

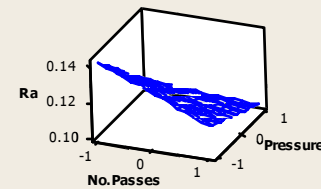
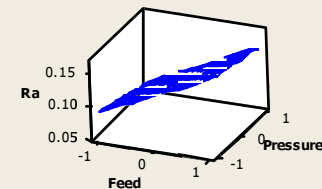
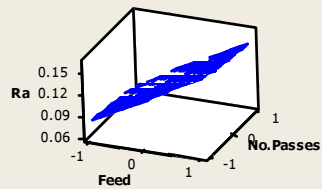
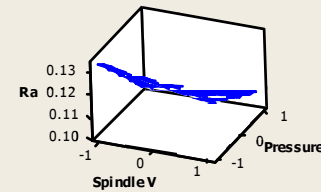
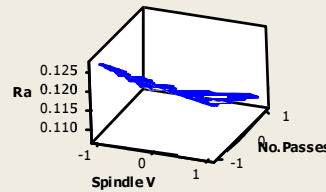
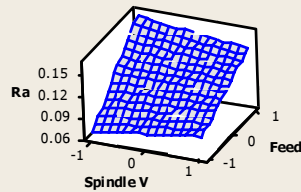


DOE for LPB

-----Surface Roughness

Surface Plots of Ra

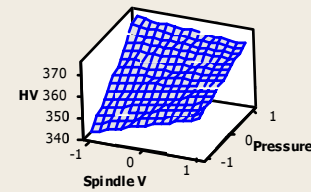
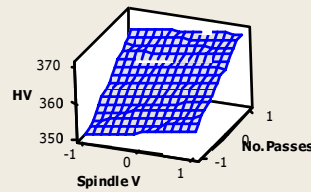
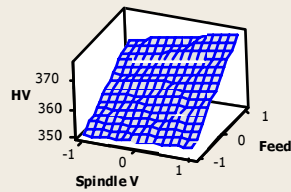
Hold Values	
Spindle V	0
Feed	0
No.Passes	0
Pressure	0



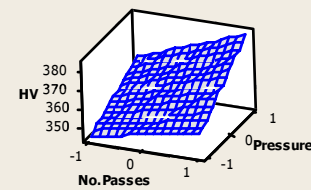
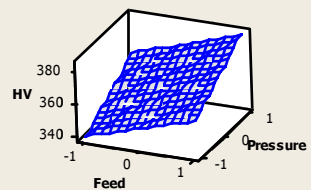
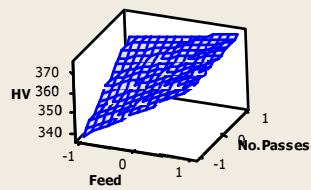
DOE for LPB

-----Surface Hardness

Surface Plots of HV



Hold Values	
Spindle V	0
Feed	0
No. Passes	0
Pressure	0



Correlation Between Micro Hardness and Residual Stress



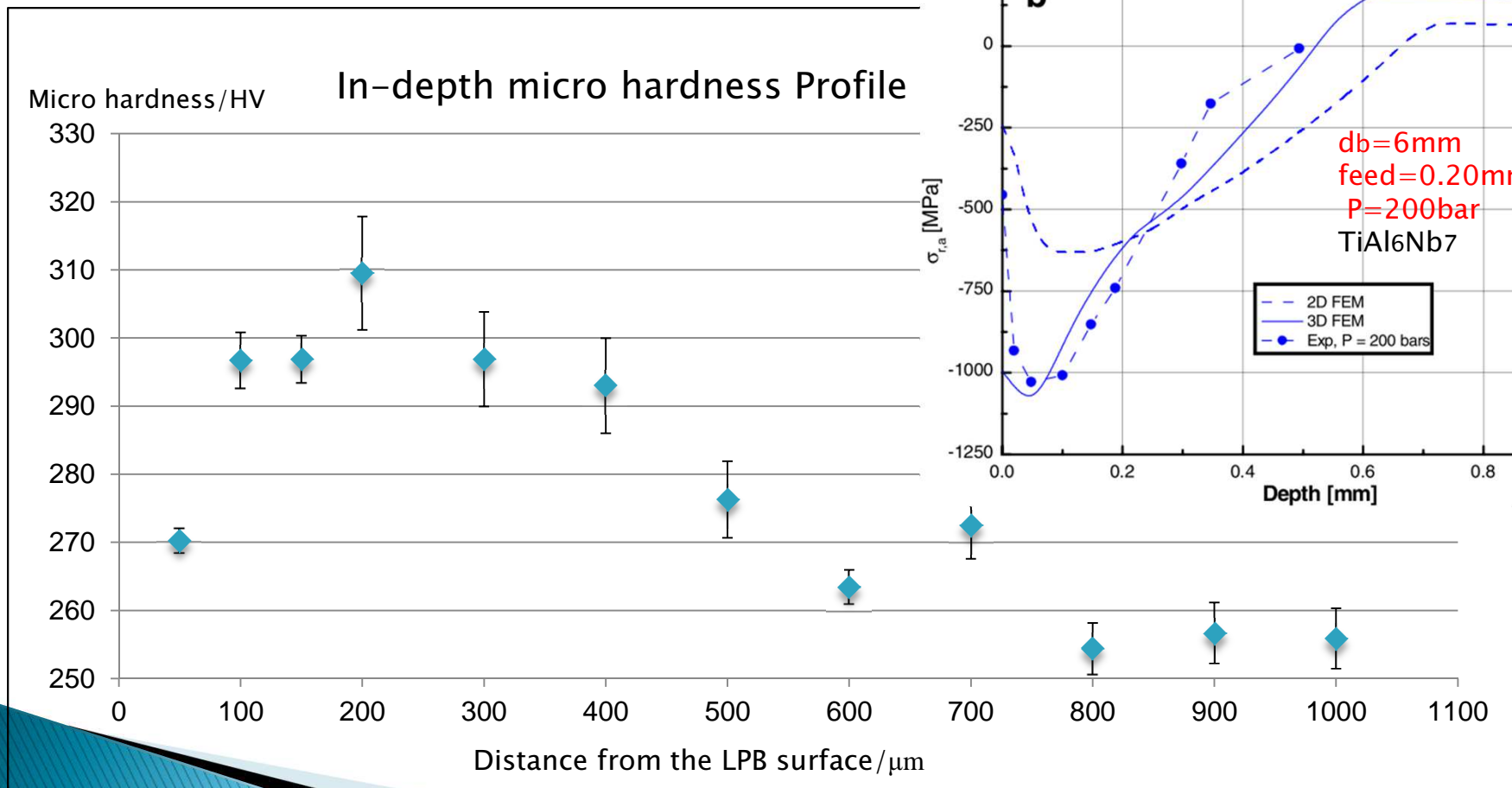
Correlation Between Micro Hardness and Residual Stress

Parameters of LPB sample #10

Spindle Velocity: 75rev/min Feed: 0.20mm/rev

#Passes: 1

Pressure: 200 Bar



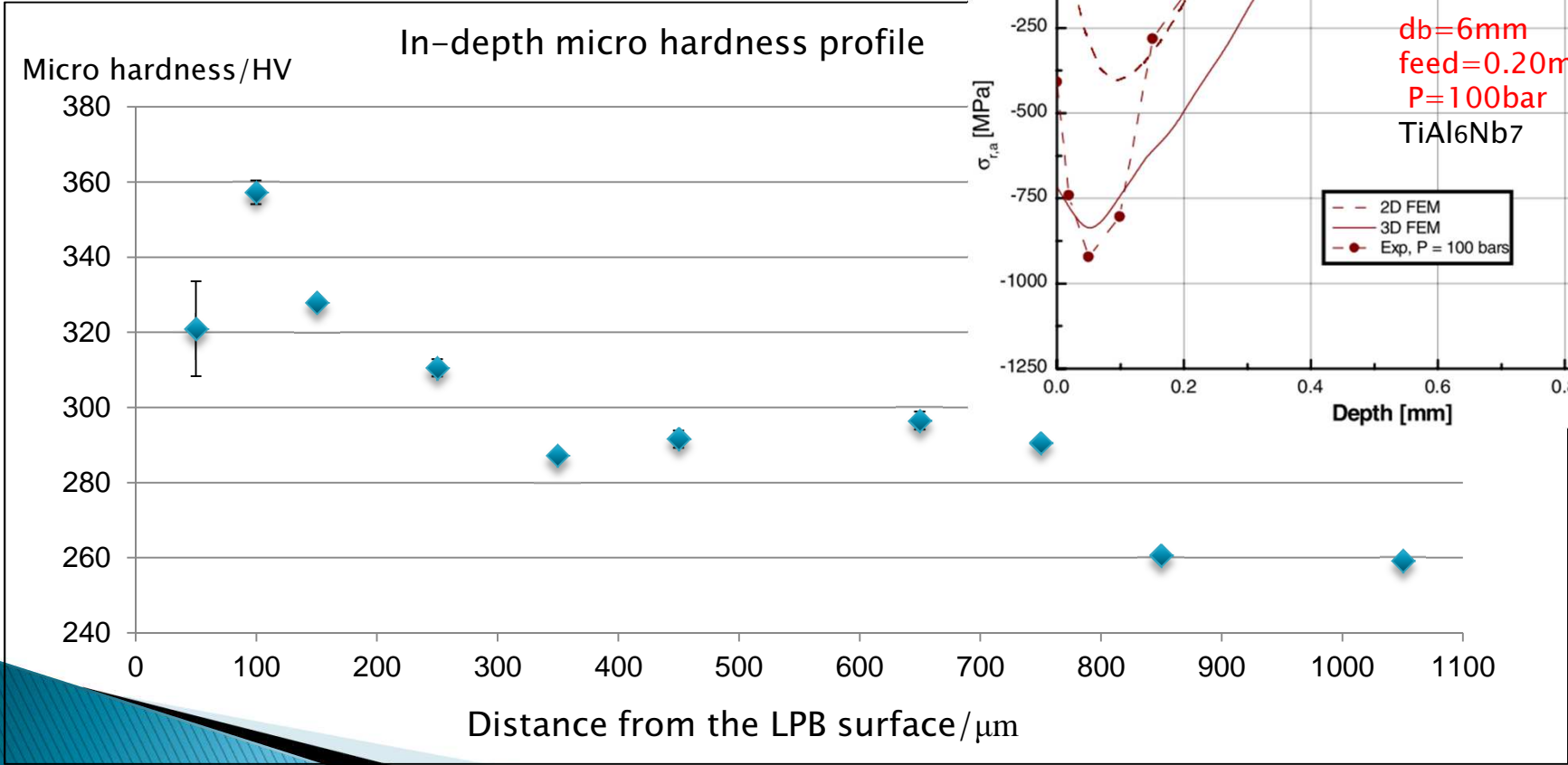
Sample #10

Load: 100g Duration:15secs

M. Sayahi 2012

Correlation Between Micro Hardness and Residual Stress

Parameters of LPB sample #4
 Spindle Velocity: 75rev/min Feed: 0.06mm/rev
 #Passes: 3 Pressure: 100 Bar



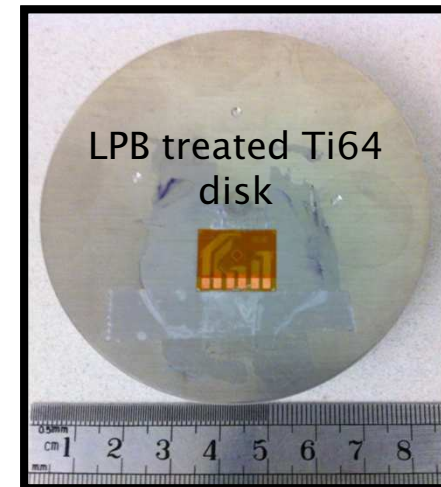
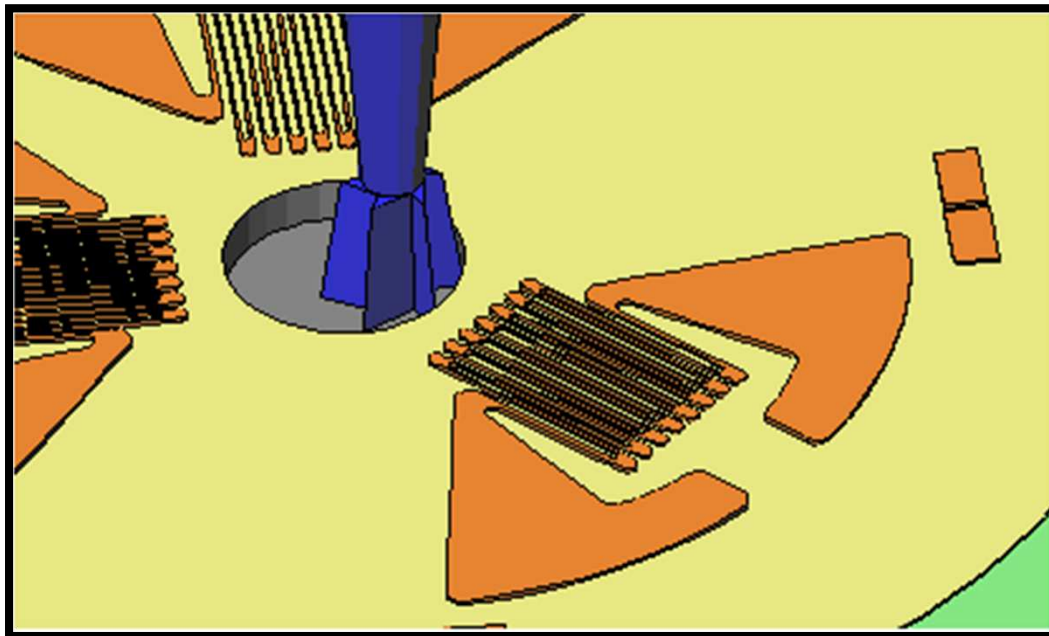
Sample #4

Load: 100g Duration:15secs

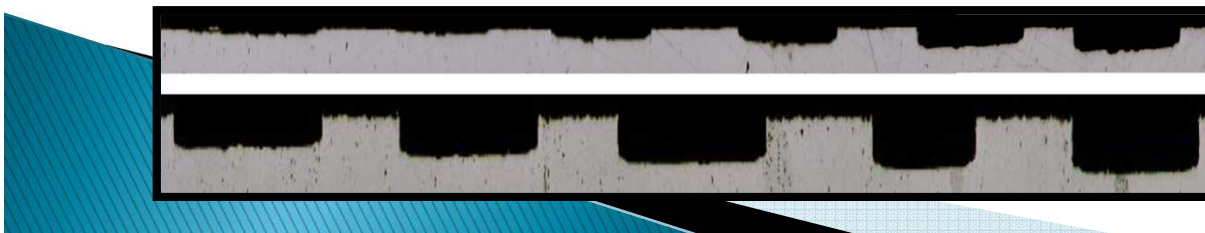
M. Sayahi 2012

Residual Stress Measurement

-----Blind hole-drilling method

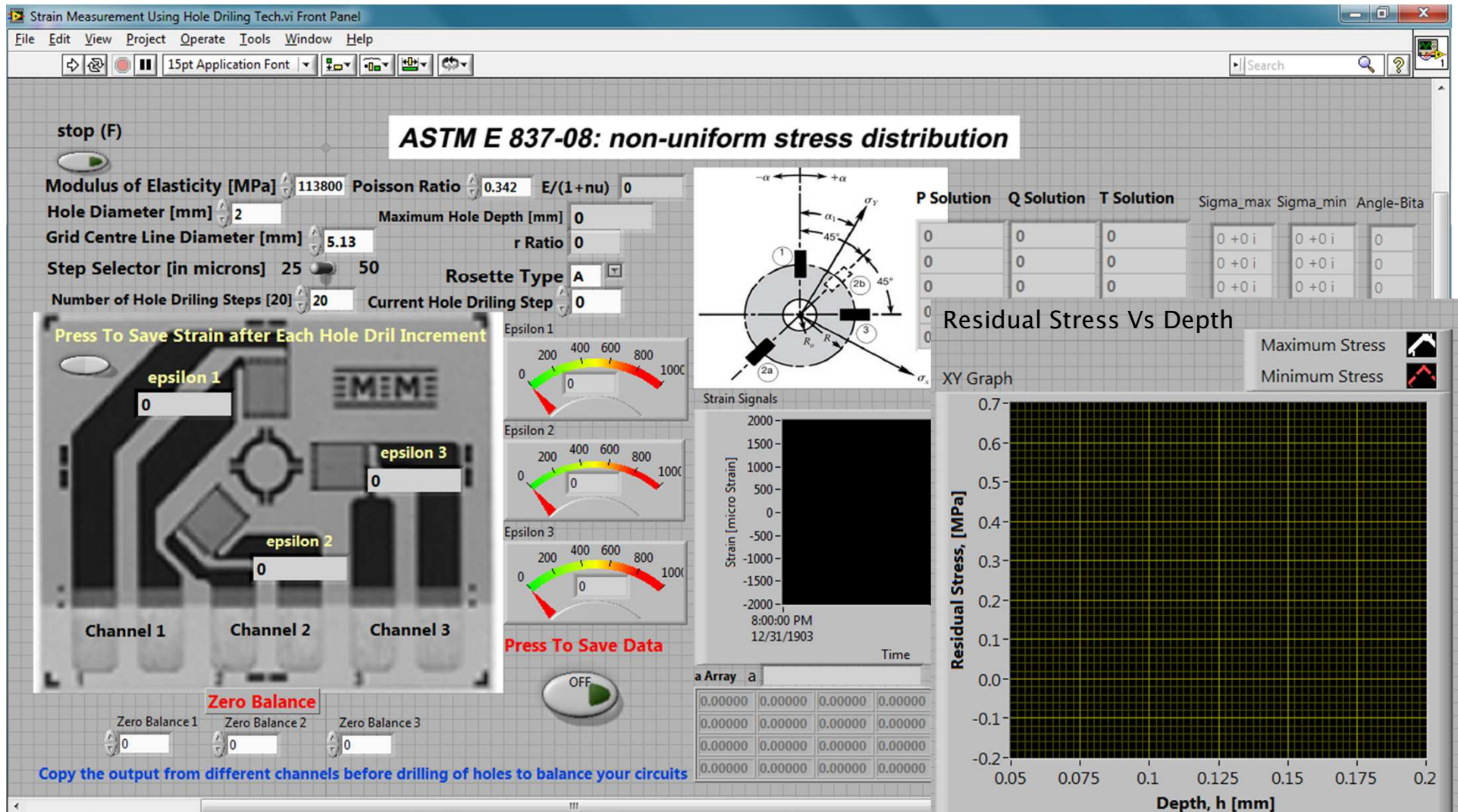


Cross sections through a series of holes showing the development of the hole profile



Residual Stress Measurement

----Blind hole--drilling method



LPB High speed Coupon Preparation



Disk #11 after water jet cutting

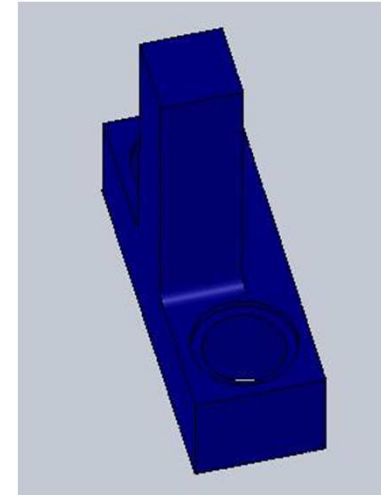
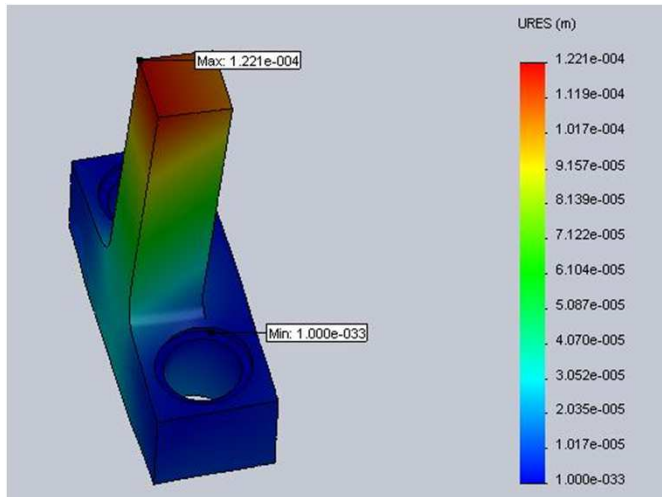
LPB treated Ti64 disk after
water jet cutting



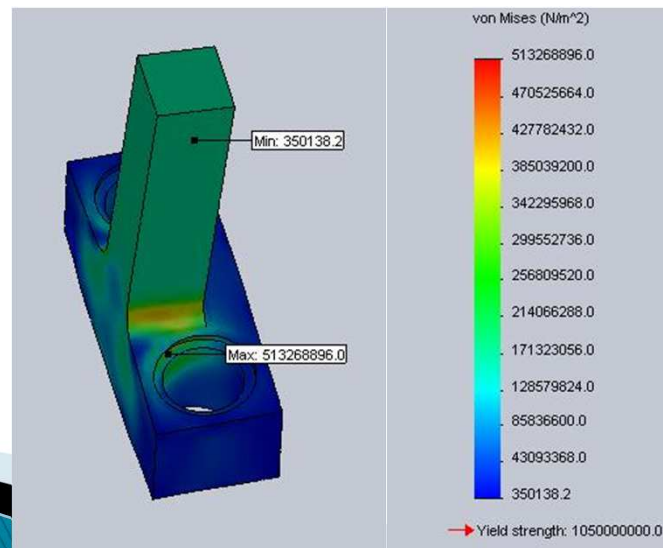
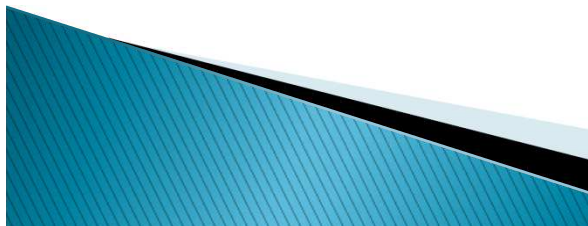
High speed coupons #11



High Speed LPB Coupons



Factor of safety > 2



Timeline

-----By the end of September

Activity	Description	Finishing percentage by the end of September 2013	Explanations
Review of low plasticity burnishing	---	100%	---
Process optimisation and evaluation of process parameters on mechanical effects	Based on DOE, samples will be manufactured and characterized by stress measurements, hardness measurements and microstructure analysis.	60% (In-depth micro hardness measurements and microstructure analysis should be able to be finished by then)	Since the residual stress measurement will be started in the middle of June (12+ week's delivery time of the hole-drilling equipment).
Compilation of Water erosion tests	LPB with various stress distributions tested on the water erosion rig.	70% (Erosion test will be started as soon as the samples are ready)	The machining of the coupons will take time and the time for finishing the testing also depends on the working schedule of the water erosion rig.
Testing	Correlation of erosion resistance and residual stresses.	60% (Correlation could be done with the tested samples)	Both the residual stress measurement and the water erosion rig test will take time and they depend on the uncontrollable factors, such as delivery time and machining time.

Timeline

-----By the end of 2013

Activity	Description	Finishing percentage by the end of 2013
Review of low plasticity burnishing	---	100%
Process optimisation and evaluation of process parameters on mechanical effects	Based on DOE, samples will be manufactured and characterized by stress measurements, hardness measurements and microstructure analysis.	100%
Compilation of Water erosion tests	LPB with various stress distributions tested on the water erosion rig.	100%
Testing	Correlation of erosion resistance and residual stresses.	100%



Thanks

