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Precision Backside Si Thinning to Land on Thin Films

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Problem/Abstract

- Need to remove handle Si (640μm thick) to land on dielectric (ARC); loss tolerance <5nm
- Final thinning uniformity must be <1μm
- Sensitive to scratches transferred to ARC layer and embedment of slurry particles in the substrate
- Process requirements strain tool capabilities
- Excellent tool qualification and repeatability required

Procedure

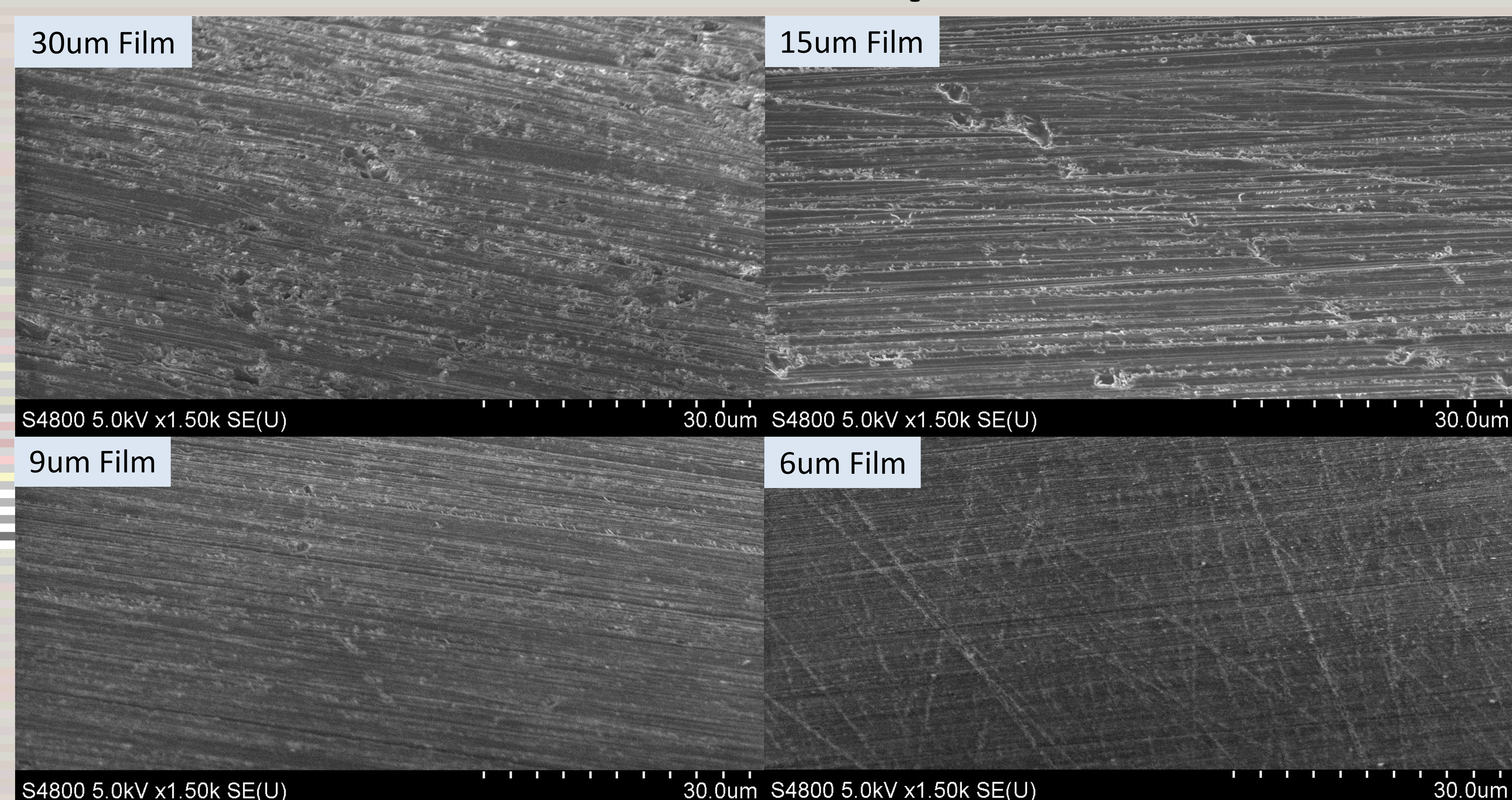
Experiment 1: Films

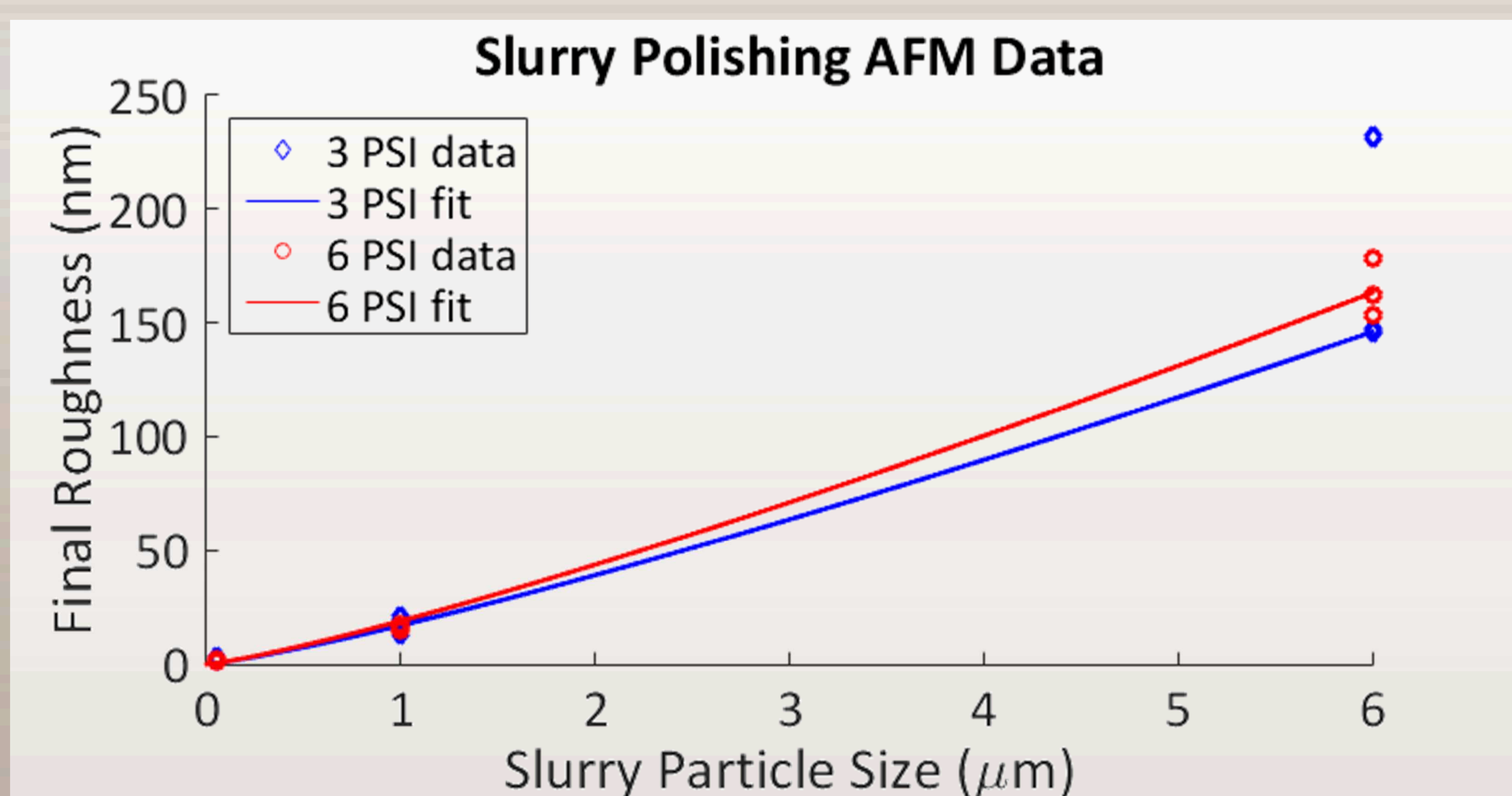
- Vary pressure (PSI) during thinning steps
- Measure removal rate, surface roughness, and corner rounding

Experiment 2: Slurry

- Run samples on slurries for a known time
- AFM resulting roughness

BKM Development



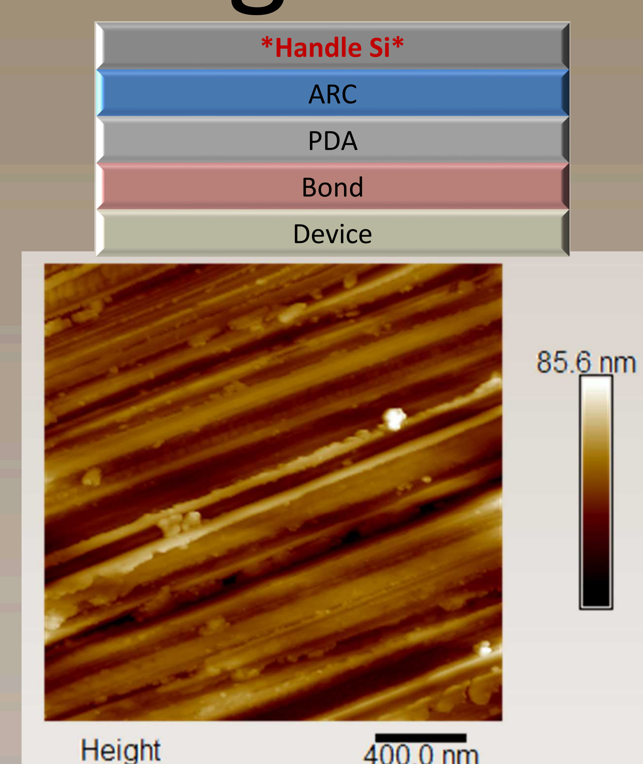


Tilt SEM of Si surface after 6PSI grind with various films (top) and surface roughness data after polish with several slurry sizes (bottom)

Future Work

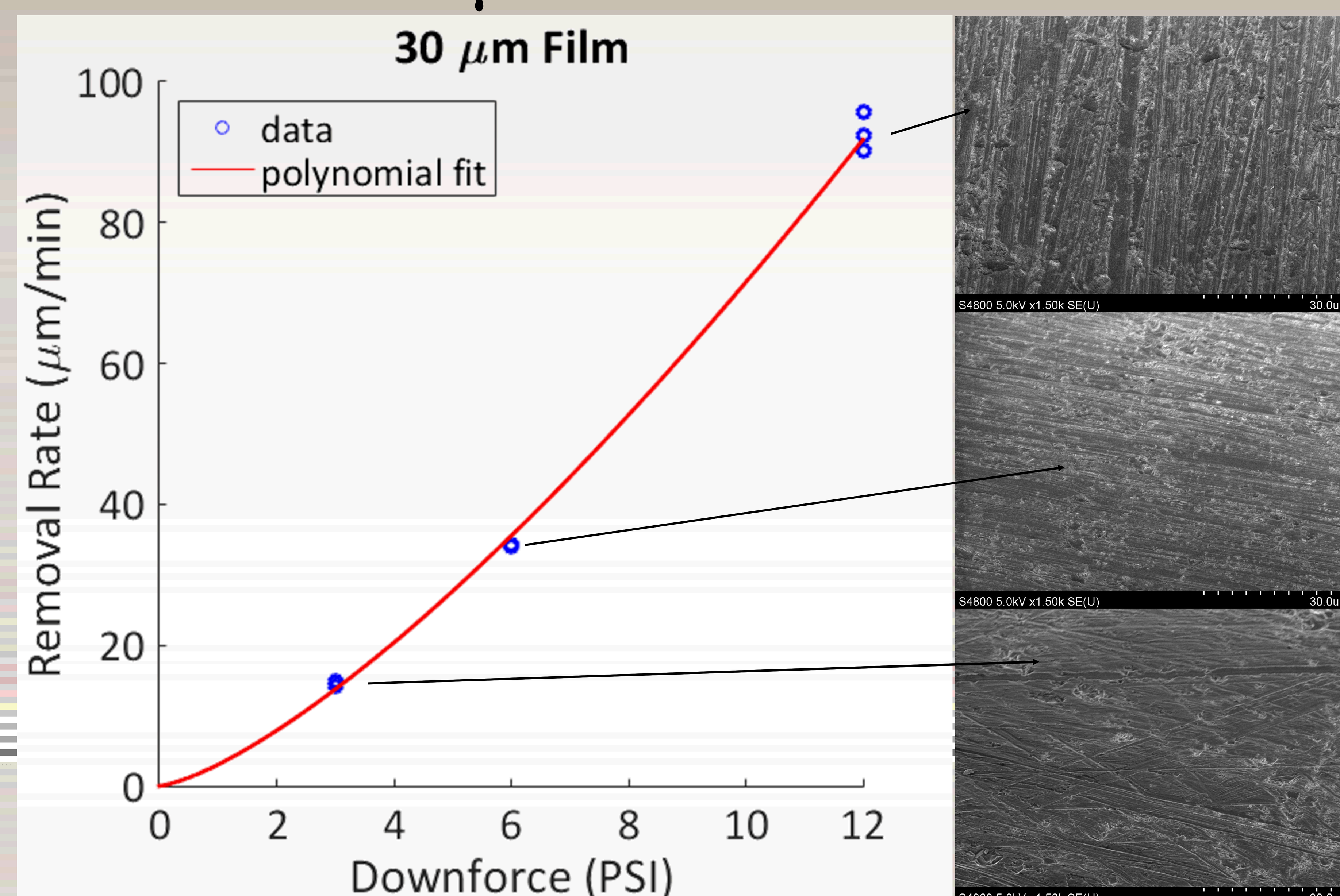
- Tailor lubricant viscosity for best surface finish
- Adjust other variables to tighten control limits
- Develop a superior die-level, post-polish clean
- Land on an ARC layer instead of final chemical thinning
- Adjust process for non-Si substrates
- Experiment with selective slurries

Background

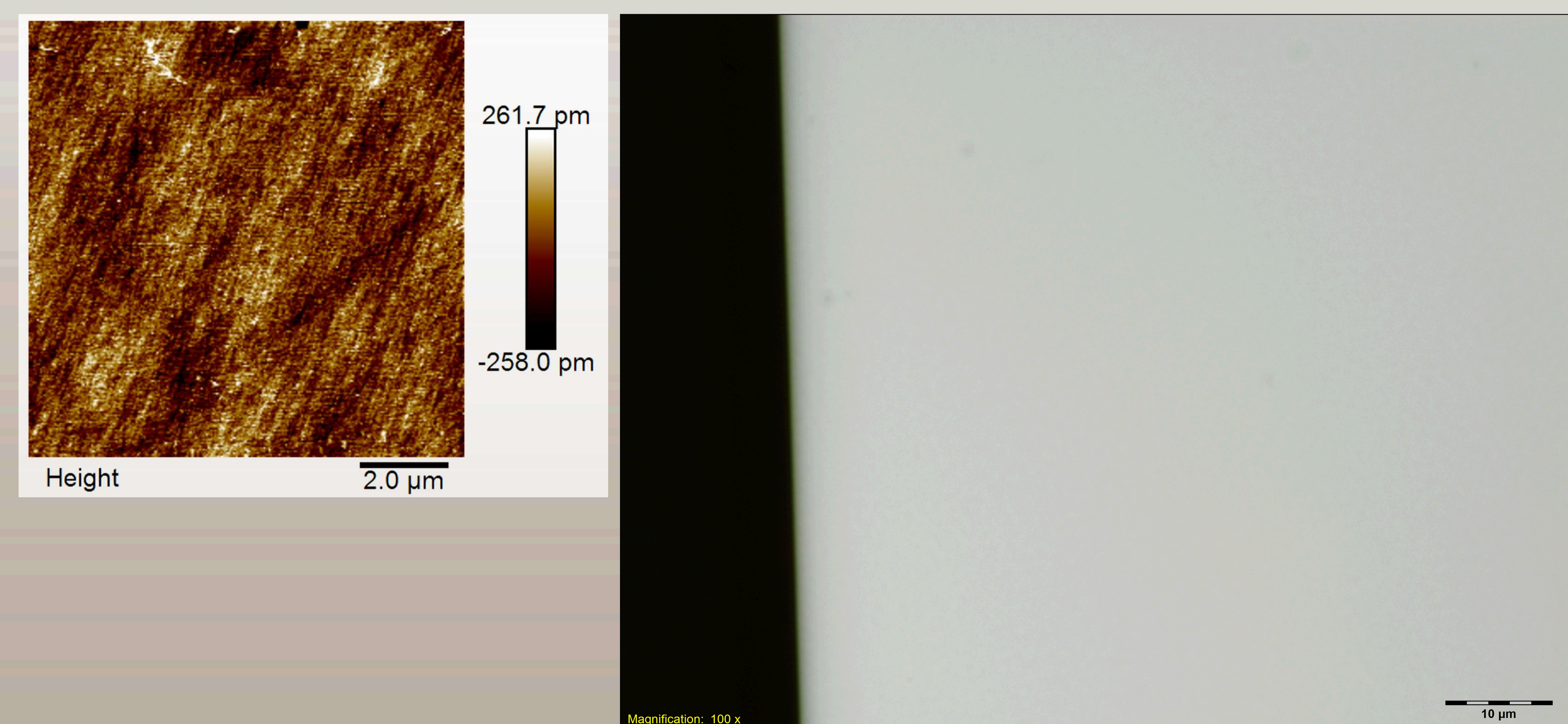


Surface roughness data (left) and optical image (right) of a part polished with initial process. Large white particles are embedded diamond.

30μm Film Results



Summary



Surface roughness data (AFM) of a part polished with developed BKM (left) and an optical image of the polished surface (right)

- 6PSI has the best results in RR variance
- Final polish 170x improvement in surface roughness
- No scratch transfer to ARC or particles embedded
- Qualify based on rate and roughness
- Upper and lower control limits defined
- Surface uniformity is now well within margin of error

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