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Fixed Abrasive Pad Development for Future CMP Process

MIPOX International Corporation

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Outline

- An Introduction to MIPOX
- Fixed Abrasive Pads (FAP)
- FAP development at MIPOX
- Basic studies
- Pad properties
- Polishing performance
- Conclusion

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An Introduction to MIPOX

- MIPOX is a subsidiary of Nihon Micro Coating of Japan
- Established in 1925
- Pioneer in polishing technology
- Well established world wide customer base for polishing

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CMP and its challenges

- Process control
- Defectivity
- Dishing/erosion
- Introduction of new materials
- Selectivity for different materials
- Waste disposal
- COO

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Abrasive Free Polishing

Current CMP Process	Partially abrasive-free process	Totally abrasive-free process
Hard or soft pads	Pads with abrasives	Hard or soft pads
Slurries with abrasives	Abrasive-free chemicals	Abrasive-free chemicals

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Fixed Abrasive Pad Development Work at MIPOX

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Objective

A simplified, cost effective CMP process compatible with conventional CMP tool platform with abrasive-free chemicals

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Fixed Abrasive Pad

- Pad structure
  - Non-foaming type
- Resin
  - Polyurethane base resin
- Abrasive
  - High purity ceria

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Basic studies

- Particle size and powder contents vs. RR
- Hardness vs. RR
- Groove optimization

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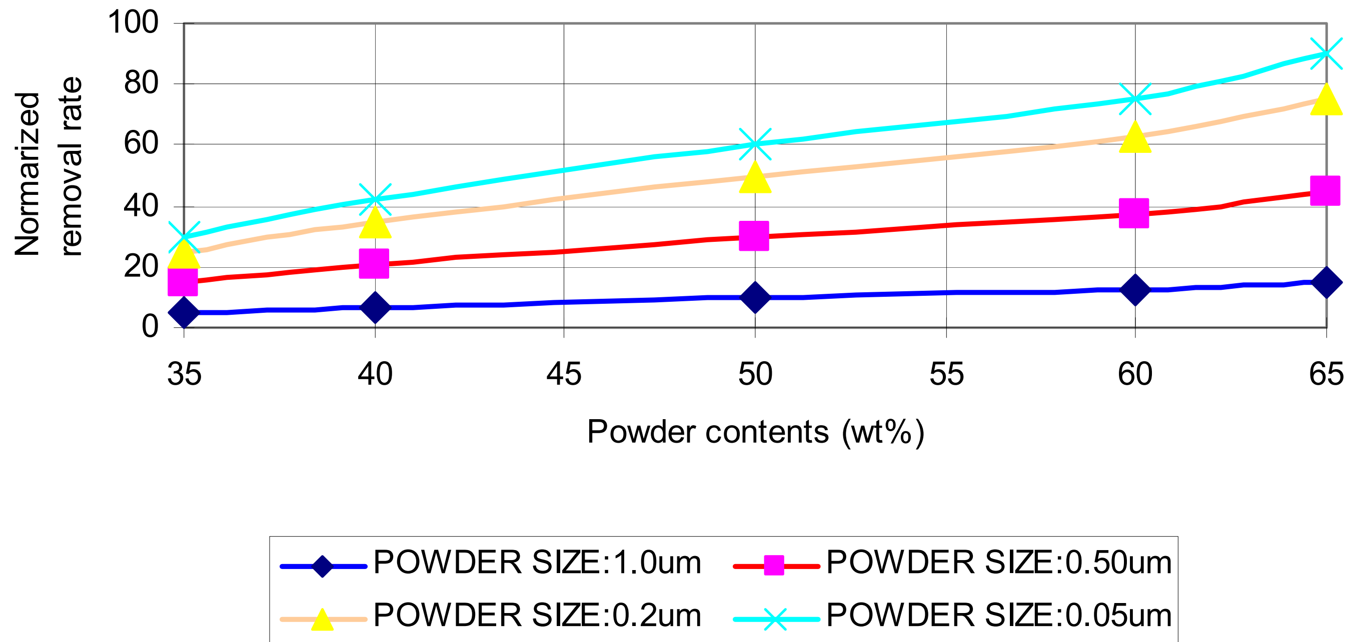
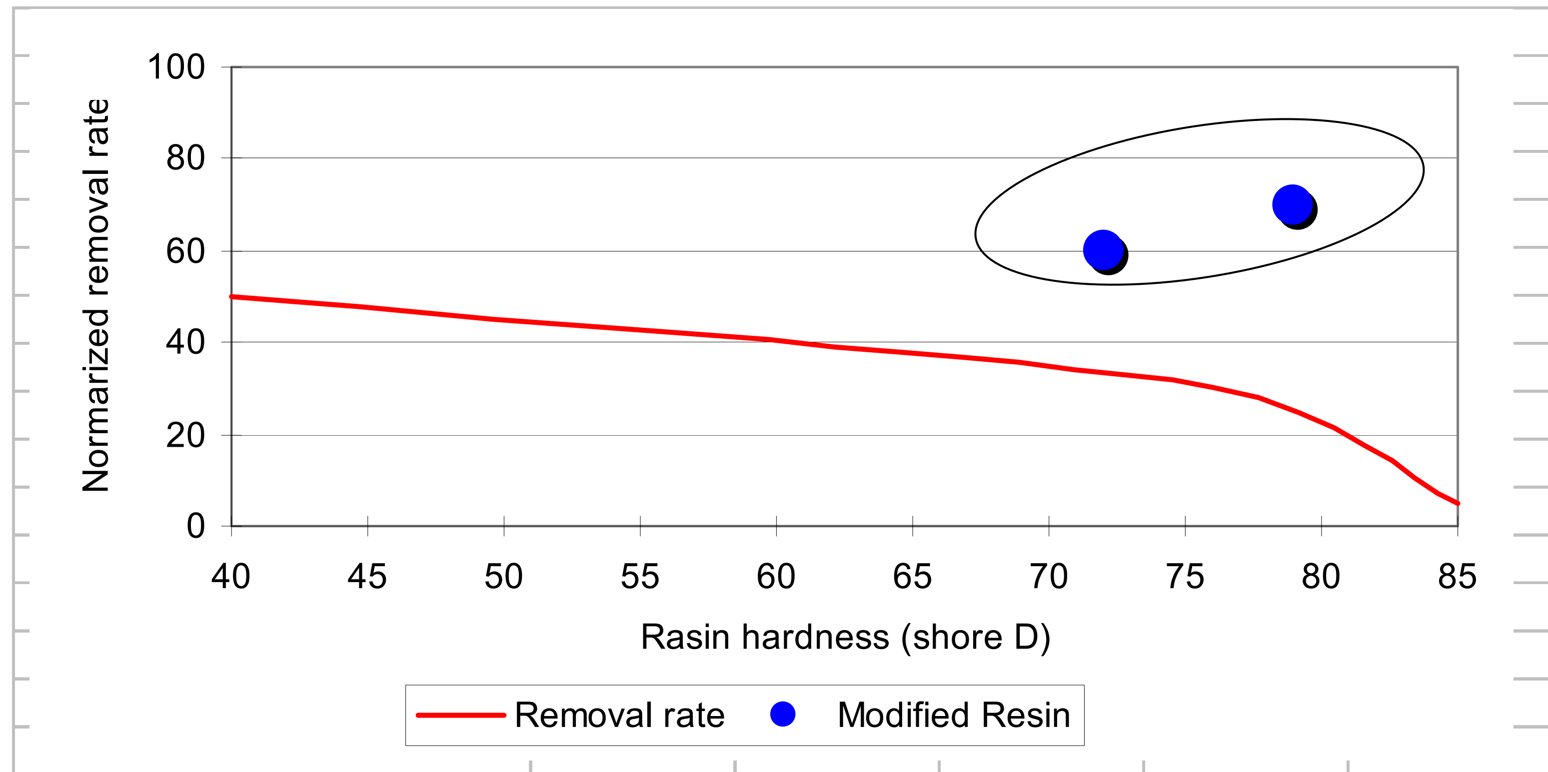
Basic Studies

Particle size and powder contents vs. RR



Basic Studies

Hardness vs. RR



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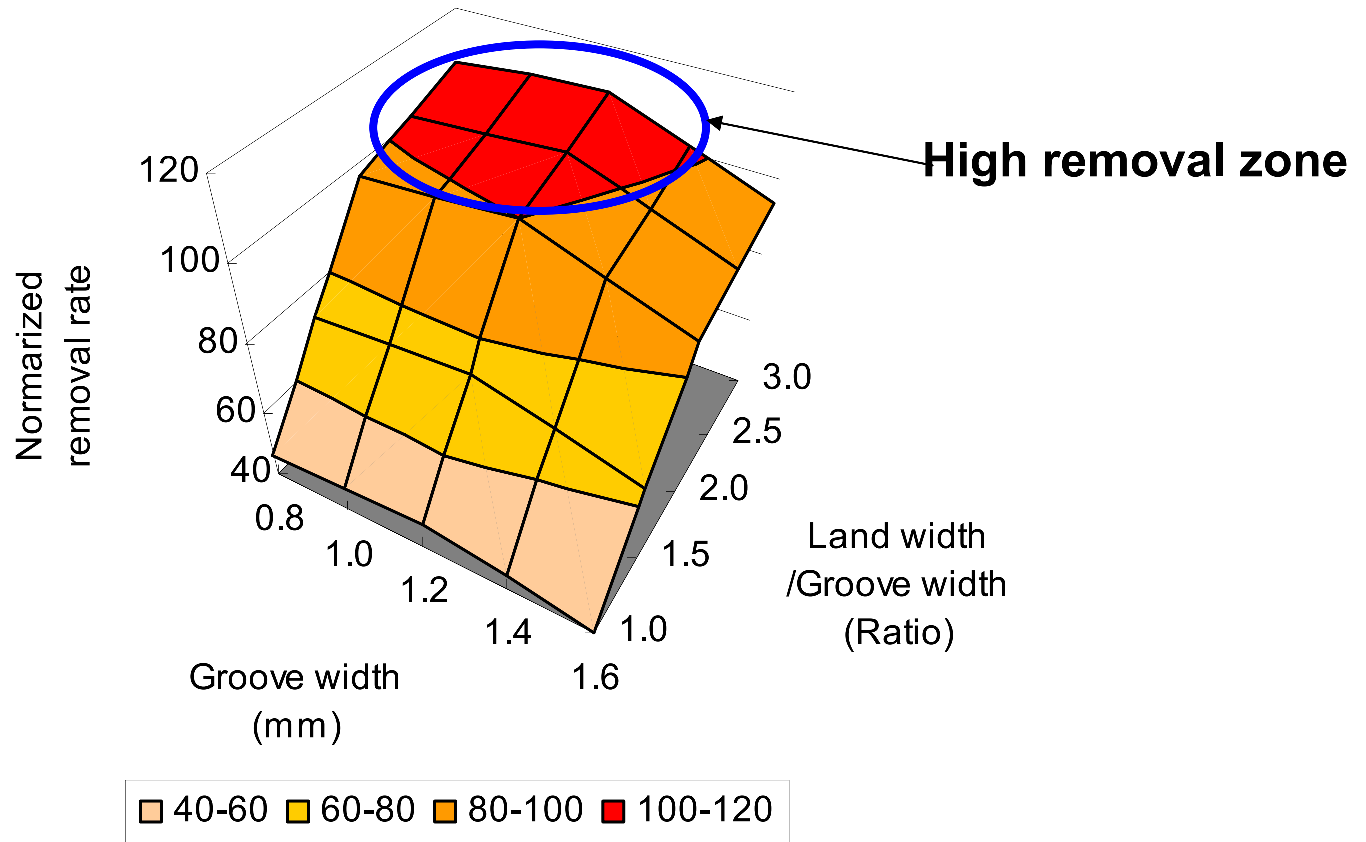
Basic Studies

Groove optimization



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Results of Basic Studies

Summary

- Smaller particles
  - Higher removal rate
- Higher particle loading
  - Higher removal rate
- Hard and brittle characteristics
  - Hard = better planarity
  - Brittle = higher removal rate

Advanced

Cmp

Pad

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ACP Properties

Physical properties

Properties	Unit	Value
Hardness	Duro shore D	88
Compressibility	%	0.37
Elastic modulus	%	86.0
Dynamic coefficient of friction		0.6

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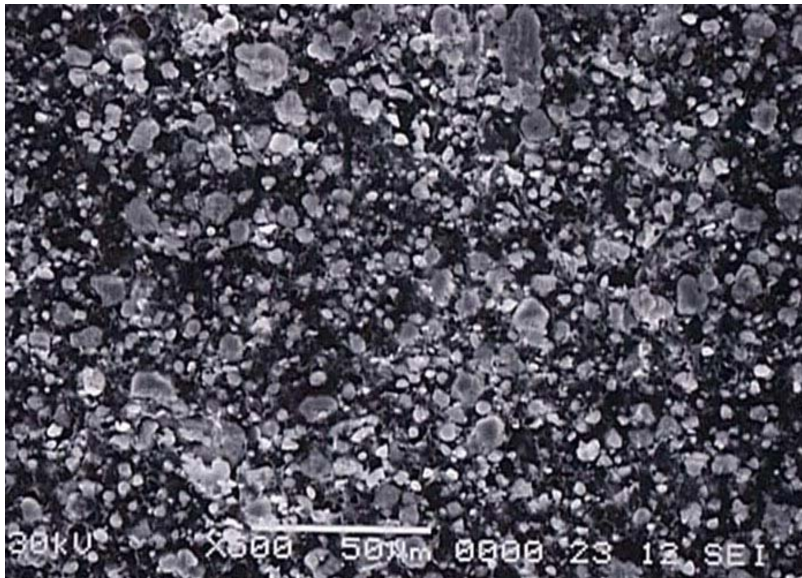
ACP Properties

SEM photos

Cross Section



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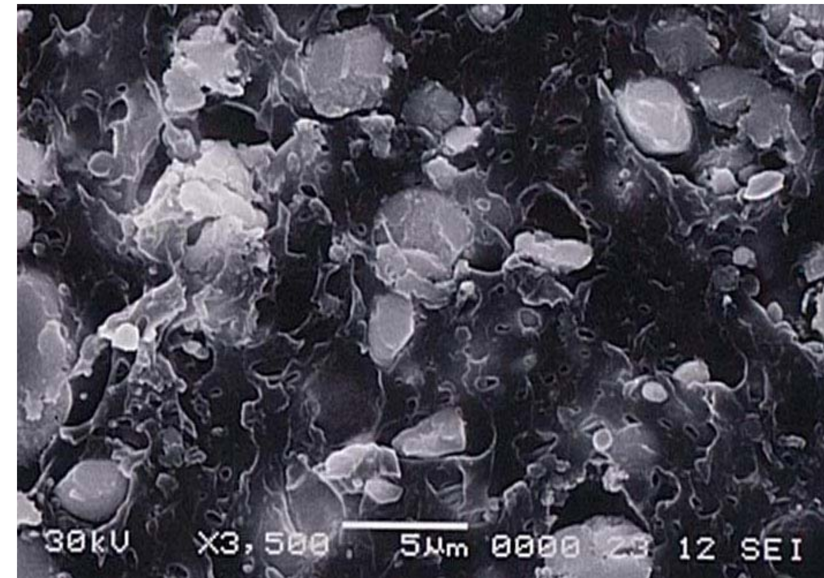

X3,500

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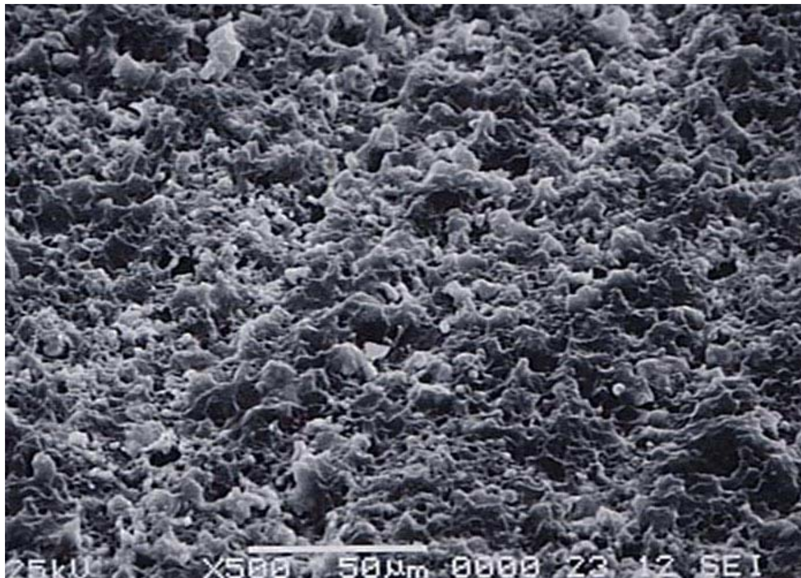
Pad Properties
SEM photos

Surface after conditioning



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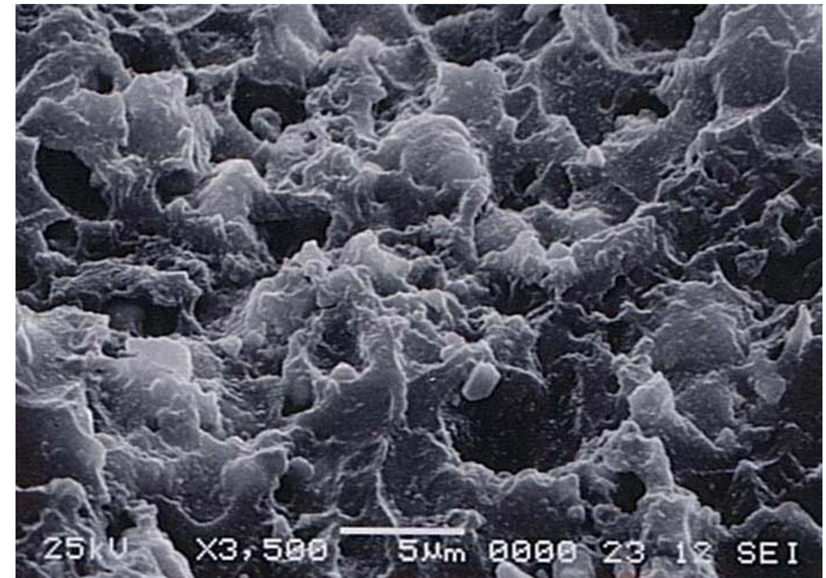

X3,500

Polishing Performance

Down force vs. platen speed

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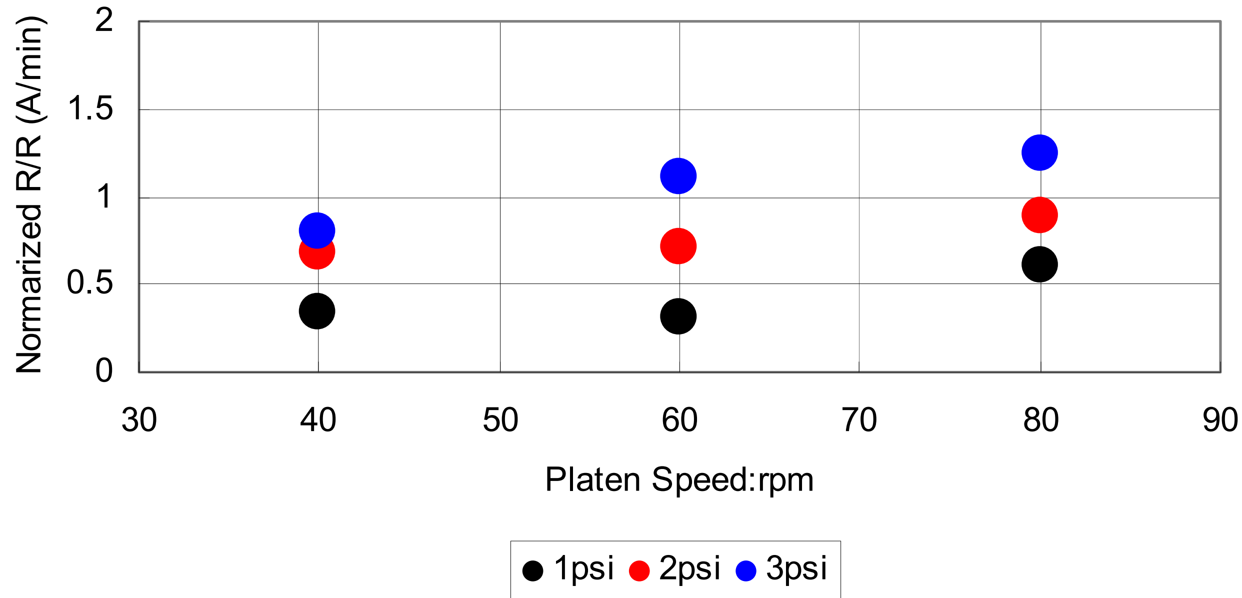
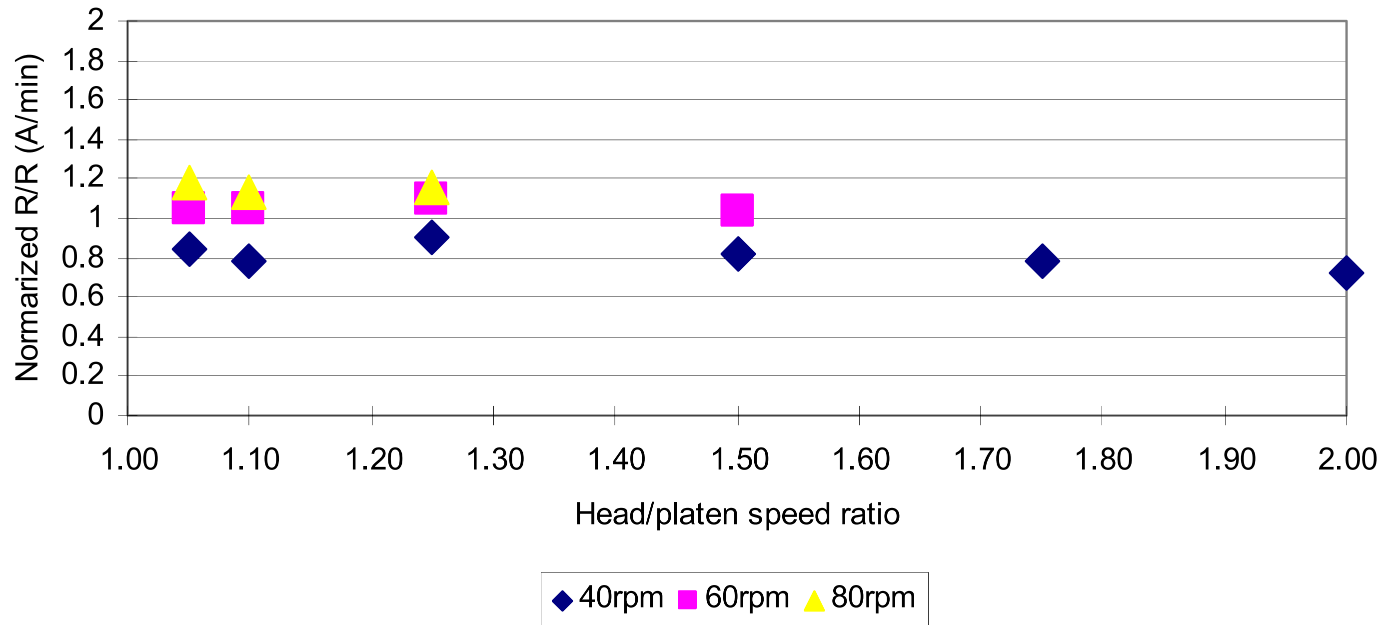


Polishing Performance

Head/platen speed ratio



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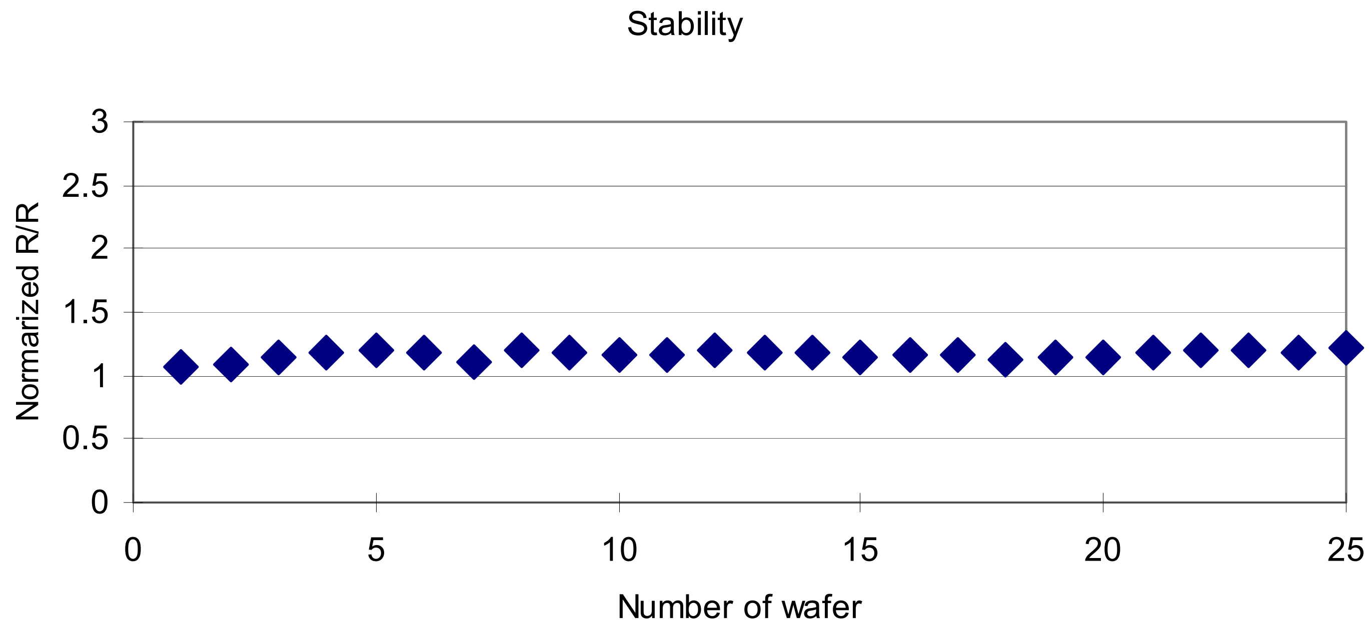
Polishing Performance

Stability



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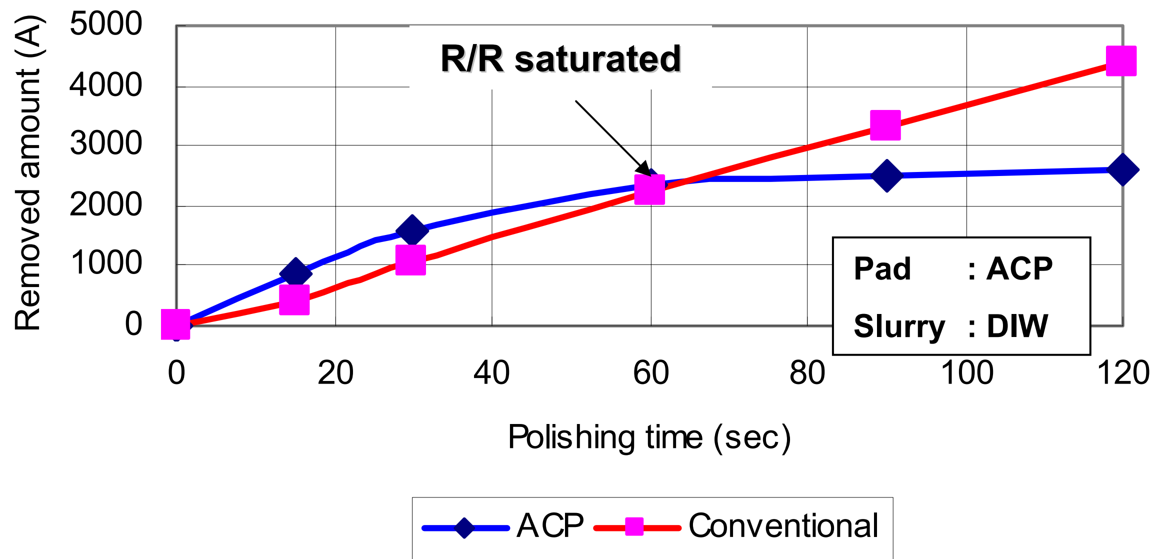
Polishing Performance

Ex-situ conditioning



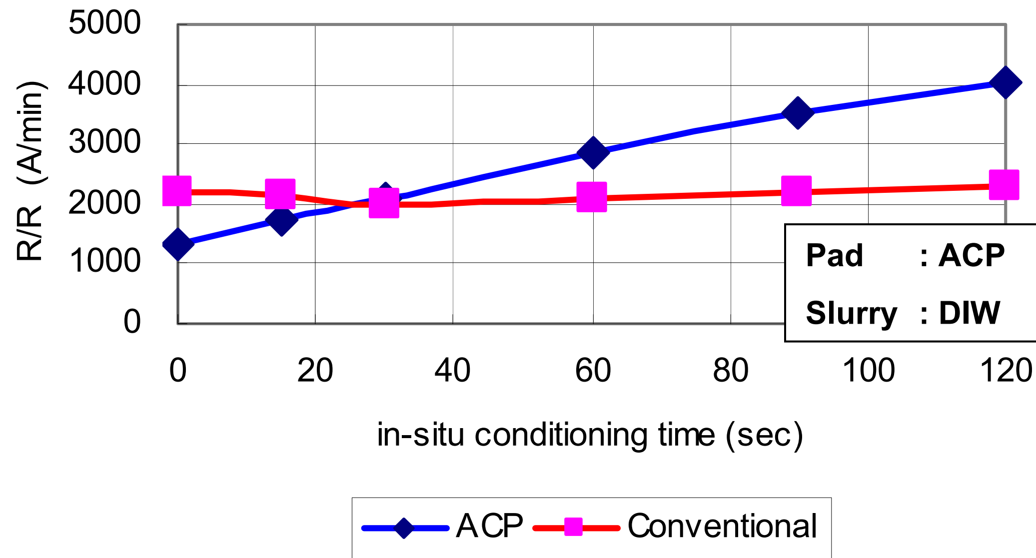
ACP Removed amount

0- 60sec : 2400A

60-120sec : 300A

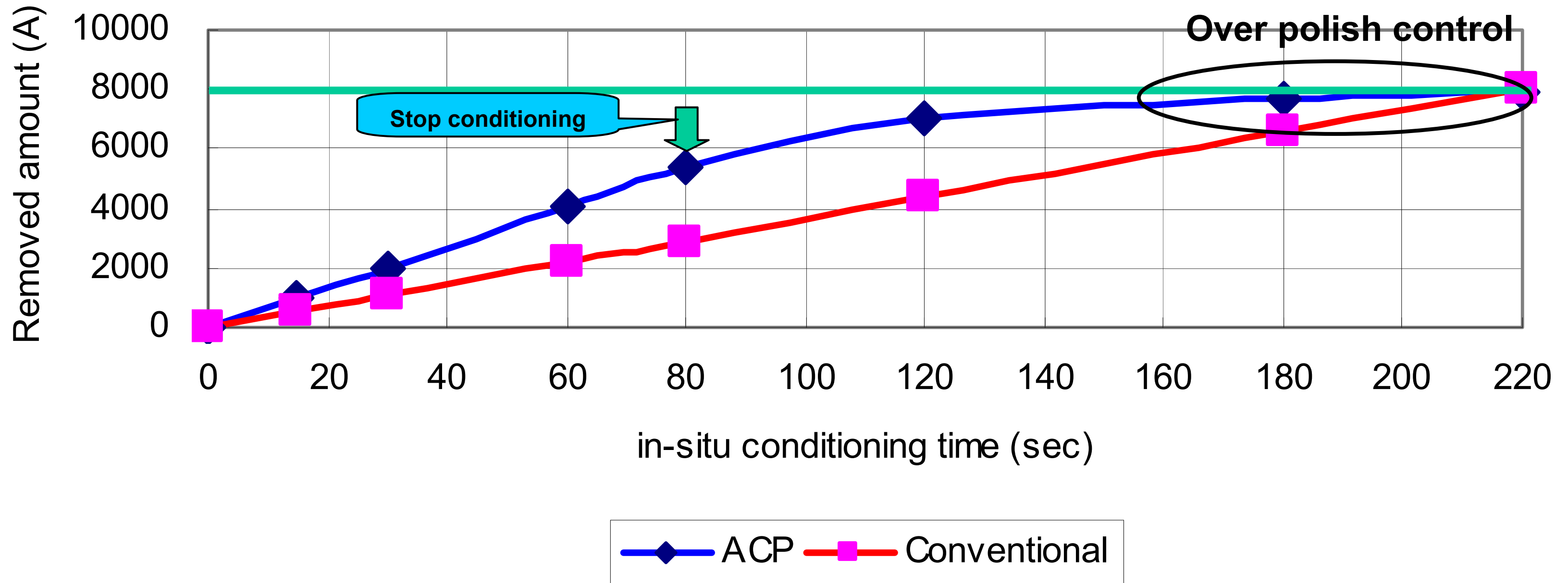
Polishing Performance

In-situ conditioning



Polishing Performance

ACP process simulation



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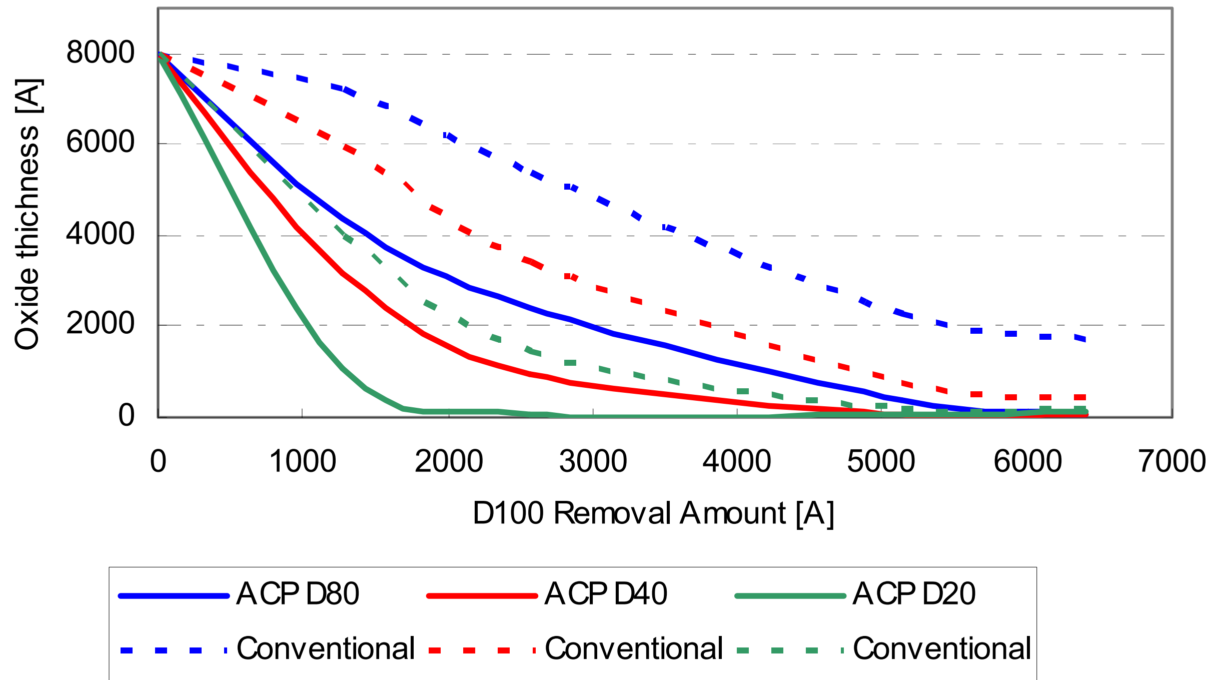
Polishing Performance

-Planarity-



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Performance Summary
Fixed Abrasive Pads

Platen speed/down force	Works well at 3 psi and >60 rpm
Head/platen speed ratio	1: 1.5
Break-in time	5-6 minutes
Stability	Stable for 25 wafers
Ex-situ conditioning	Maximum RR achieved at 60 seconds and then leveled off.
In-situ conditioning	60 seconds adequate. RR continues to increase with time.
Standard process	Conditioning – 80 seconds With ACP, over-polishing can be controlled
Planarity	Pattern density dependence is low Planarity is high

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Conclusions

- ACP was developed for polishing with abrasive-free chemicals
- ACP polishing characteristics are different from conventional CMP pads.
- Resin hardness and brittleness are key parameters.
- Good candidate for environmentally friendly, cost-effective CMP process.

Need to investigate…..

- Defectivity
- Process efficiency
- COO