Changing slurry formulations – Issues and Observations

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Overview of SVTC

Problem Statement

Experimental plan

Results
  • Blanket and Pattern oxide polish
  • Summary

Results
  • Particle
  • Summary

Conclusions
Bridging the Gap

Universities and Labs

Commercialization Gap

Foundries IDM Operations

Research

Prototyping

Development

Pilot/Production

High Volume

Innovation Phase
Problem Statement

Problem:

- In SVTC we have a complex business model allowing customers to run their own processes as well as for SVTC to process wafers for them.

Why:

- Cabot stopping manufacturing of SC1 slurry which impacts everyone.

Solution:

- Collection of data and present to our customers and implement with little impact to customers learning curve and processes.
Experiment plan

Plan:

- Blanket Polish using OXIDE over SI wafers.
  - Polish Rate
  - Uniformity

- Pattern wafer polish 30-45% pattern density.
  - NIT
  - OXIDE

- Particle Test.
  - .16 Um
  - .25 um

- Collection of statistical data within a quarter on different days.
  - 1. Blanket
  - 2. Patterned
  - 3. Particle
RESULTS: Blanket OXIDE Polish Data

Summary:

- D112 slurry has constant delta with SC1 and slower Removal Rate than SC1.
- D112 3 Sigma % Standard Deviation is overlapping with SC1.
RESULTS: OXIDE Pattern Wafer Polish Data

Summery:

- D112 Pattern showing slower removal rate than SC1 with different pattern density wafers.
- D112 showing lower uniformity across wafer than SC1 with different pattern density wafers.
RESULTS: 30% Patterned density NITRIDE Data

Summery:

- Pattern NITRIDE wafer polish with 30% pattern density
- D112 showing slower Removal Rate then SC1.
- D112 has better uniformity then SC1
Experiment Summary OXIDE and NITRIDE

Experiment Summary:

- Blanket wafers OXIDE polish showing lower removal rate and better uniformity with D112 slurry
- Pattern wafers with 30% and 45% pattern density OXIDE and NITRIDE showing same difference of lower removal rate and better uniformity with D112 slurry
- With SVTC complicated and unique processes base on experiment data needed to look at a simple low impact adjustment to resolve the lower rate issue

Solution:

- Show statistical data to our customers with process effected and implement fix.
- By a small tweak to process recipe can achieve same rate results as SC1 with out impact to learning and process.
Summery:

- With Fresh D112 slurry can achieve save particle counts as SC1
- D112 Slurry increase in particle when same slurry used multiple days.
Experiment Summary Particles

Experiment Summary:

- D112 slurry showing same particle results as SC1 when slurry is fresh

Problem:
- When same slurry used multiple days particle results increase
- Slurry showing crystallization when slurry is exposed to ambient air
- Slurry was not going through filtering
- Repeat same experiment with only fresh slurry to see repeatability.
Experiment Particle Data Repeatability test.

Summary:

- Repeating particle with Fresh D112 slurry can achieve save results again.
Experiment Summary:

- Repeating experiment with fresh D112 slurry
  - Achieved same particle results as initial experiment

- Solutions:
  - Look at our slurry distribution system
  - Filtering D112 slurry same as SC1
Conclusion:

• Blanket, pattern OXIDE and NITRIDE polish showing lower removal rate but better uniformity with D112 slurry and can archive same removal rate as SC1 with tweak to process recipe

• D112 slurry showing same particle results as SC1 with fresh slurry and repeatable

• Repeat experiment with solutions added (filter, distribution)