

Stabilization of pH in Oxide Slurry

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PATENTS PENDING

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Silco Electronic Materials -

- Division of Silco International LLC
- New, Automated Facility in Portland, OR
- Focused on Slurry Purity & Consistency
- Using Levitronix Technology
- A New Class of CMP slurries !

Outline

- Background
- Challenges
- Current Methods
- Silco Process
- Summary

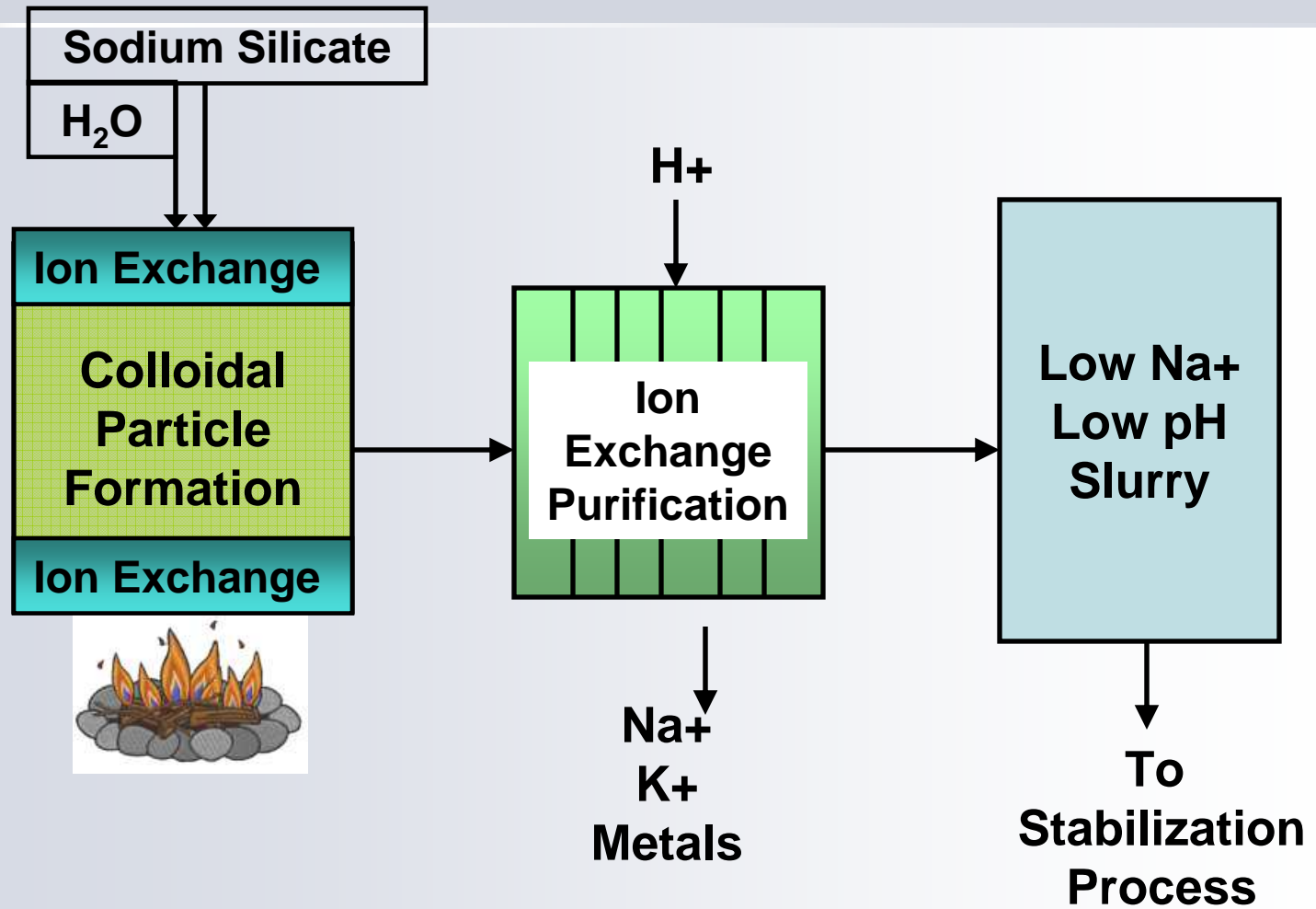
Background

- Colloidal silica manufacturing
- Sodium in dense silica matrix
- Removal and replacement of ions using ion exchange process
- CMP dependence on pH ?

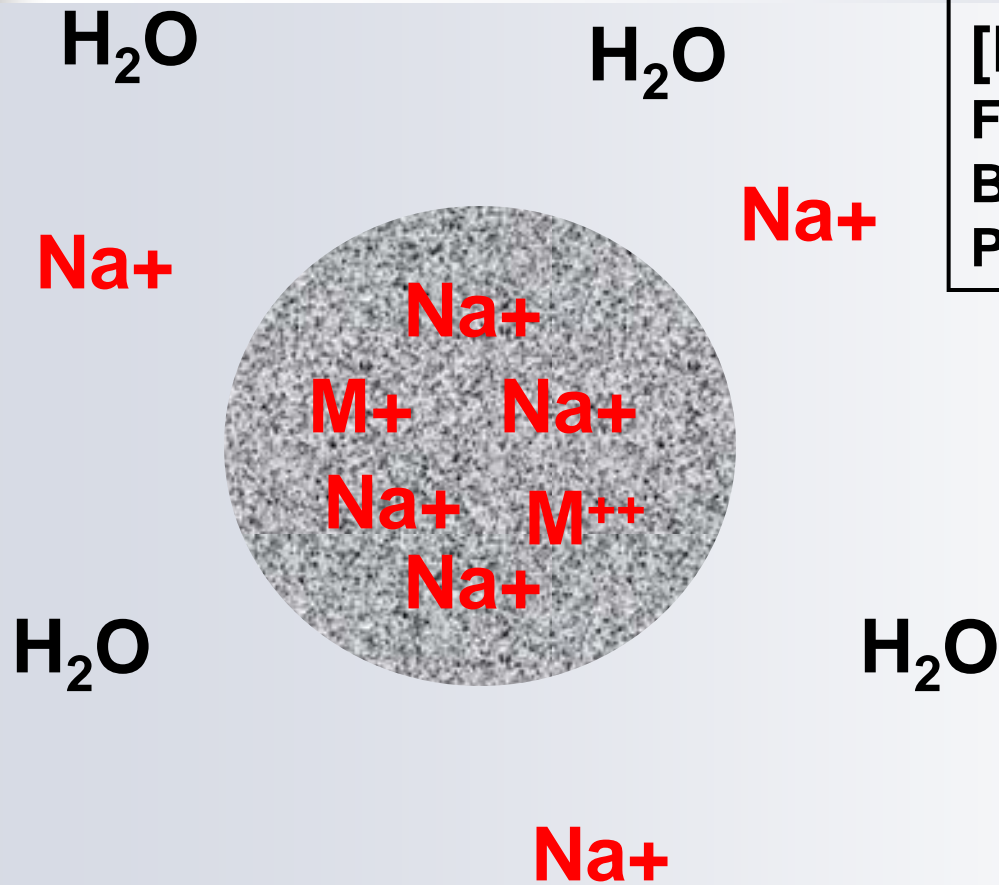
Challenge #1

- Sodium Removal
 - Ion exchange purification process
 - [Na⁺] in water vs. particles
 - Concentration gradients
 - Particle density

Background, cont.

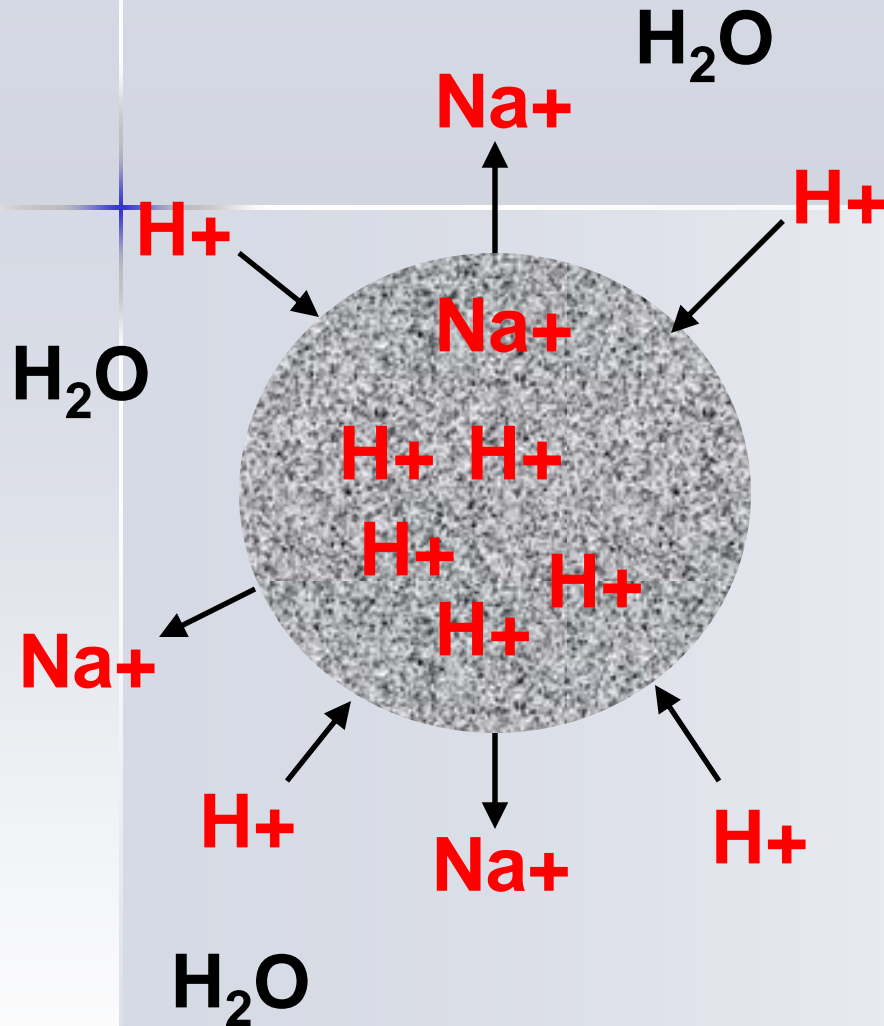


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**[Na⁺] EASILY REMOVED
FROM WATER PHASE,
BUT NOT FROM DENSE
PARTICLE MATRIX**

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[Na⁺] EASILY REMOVED FROM WATER BY IEX PROCESS, BUT REMAINS TRAPPED IN DENSE PARTICLE MATRIX

OVER TIME, TRAPPED [Na⁺] IONS LEACH OUT INTO WATER PHASE

MULTIPLE IEX STEPS REMOVE REMAINING Na⁺, GIVING LOW pH SLURRY PRODUCT

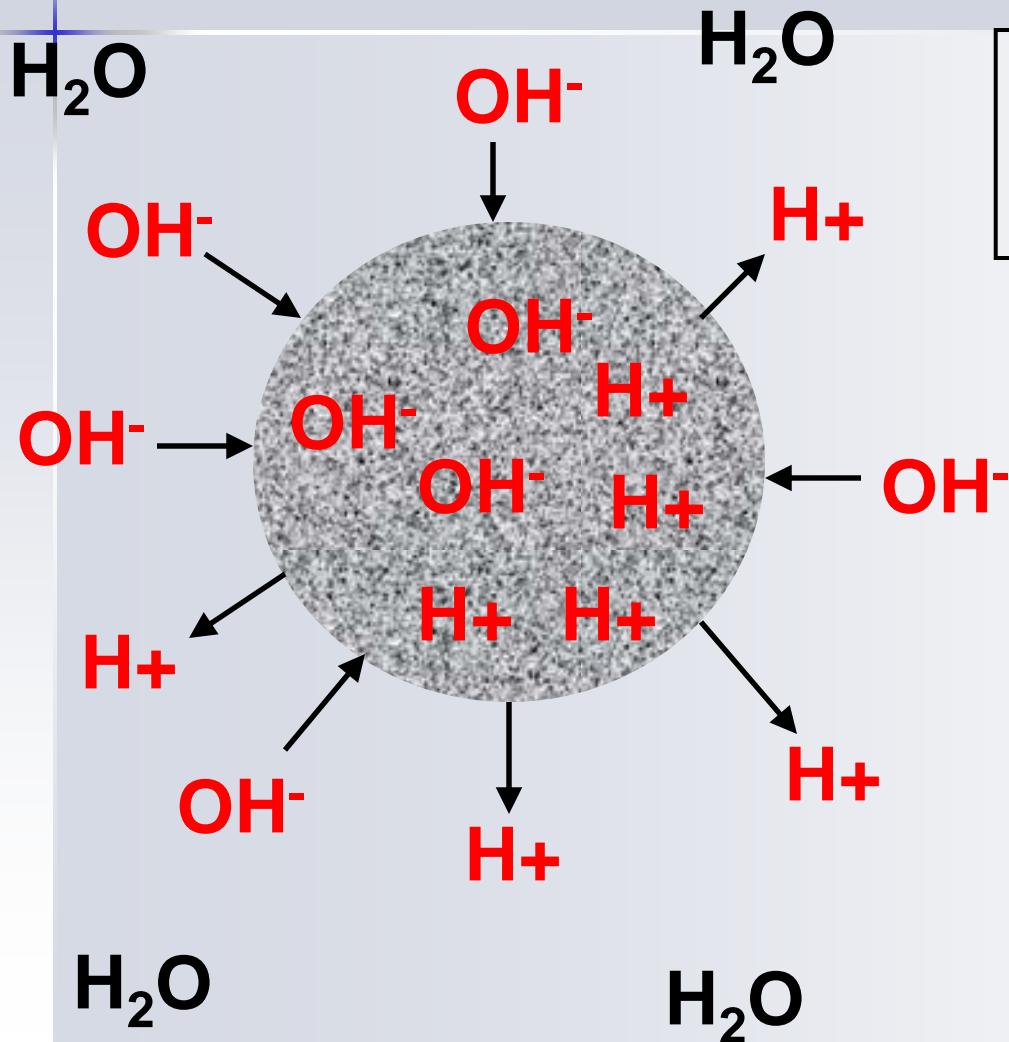
Challenge #2

- pH stabilization of slurry with KOH
 - Inverse of Na⁺ removal challenge
 - Current methods effective ?
- Goal to insert OH⁻ into particle matrix
 - No agglomeration
 - No microgel from pH micro-gradients
 - Efficient hydroxide insertion
 - Achieve pH-stable CMP slurry

Current Methods for Stabilization

- Add KOH, Wait, Repeat
 - Concentration gradient - driven
 - Low shear mixing
 - Results in high [KOH] in slurry
 - Potential for microgel formation
- Same as Above, but w/ High Shear
 - Faster than above due to energy input
 - Potential for particle damage
 - Still requires multiple dose & wait

Current Methods, cont.



[OH⁻] INSERTION REQUIRES ENERGY TO PENETRATE INTO PARTICLE MATRIX

HIGH [OH⁻] GRADIENT-DRIVEN WORKS OVER TIME (EVENTUALLY)

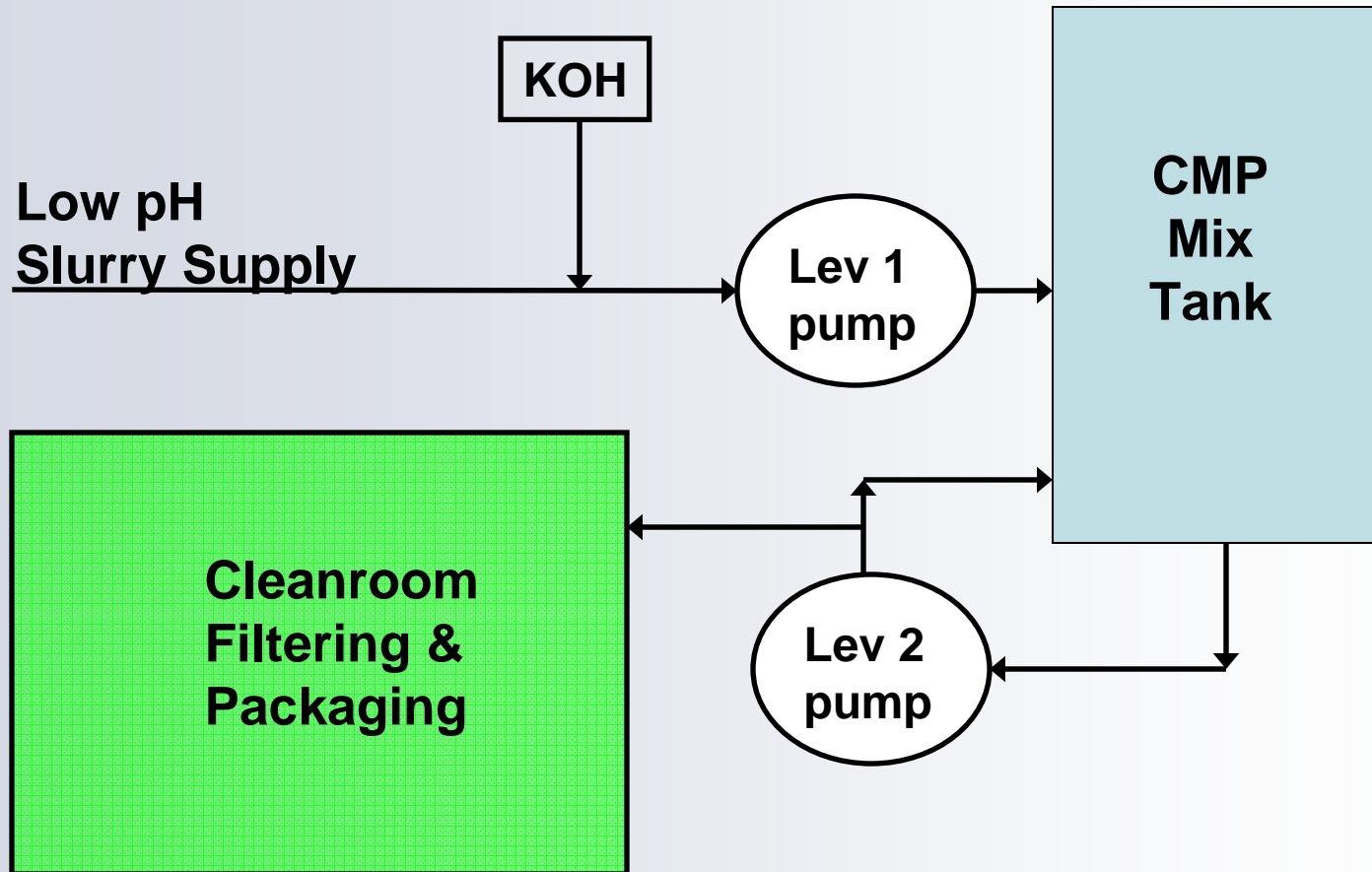
PROCESS REQUIRES HIGH KOH CONC. AND TIME... A LOT OF TIME.

The Silco Process

- High Energy Levitronix Pump
 - Minimum damage to particle
 - Minimum amount of KOH added
 - Minimum time to stabilize
 - Gives exceptionally stable pH
 - More efficient for manufacturing

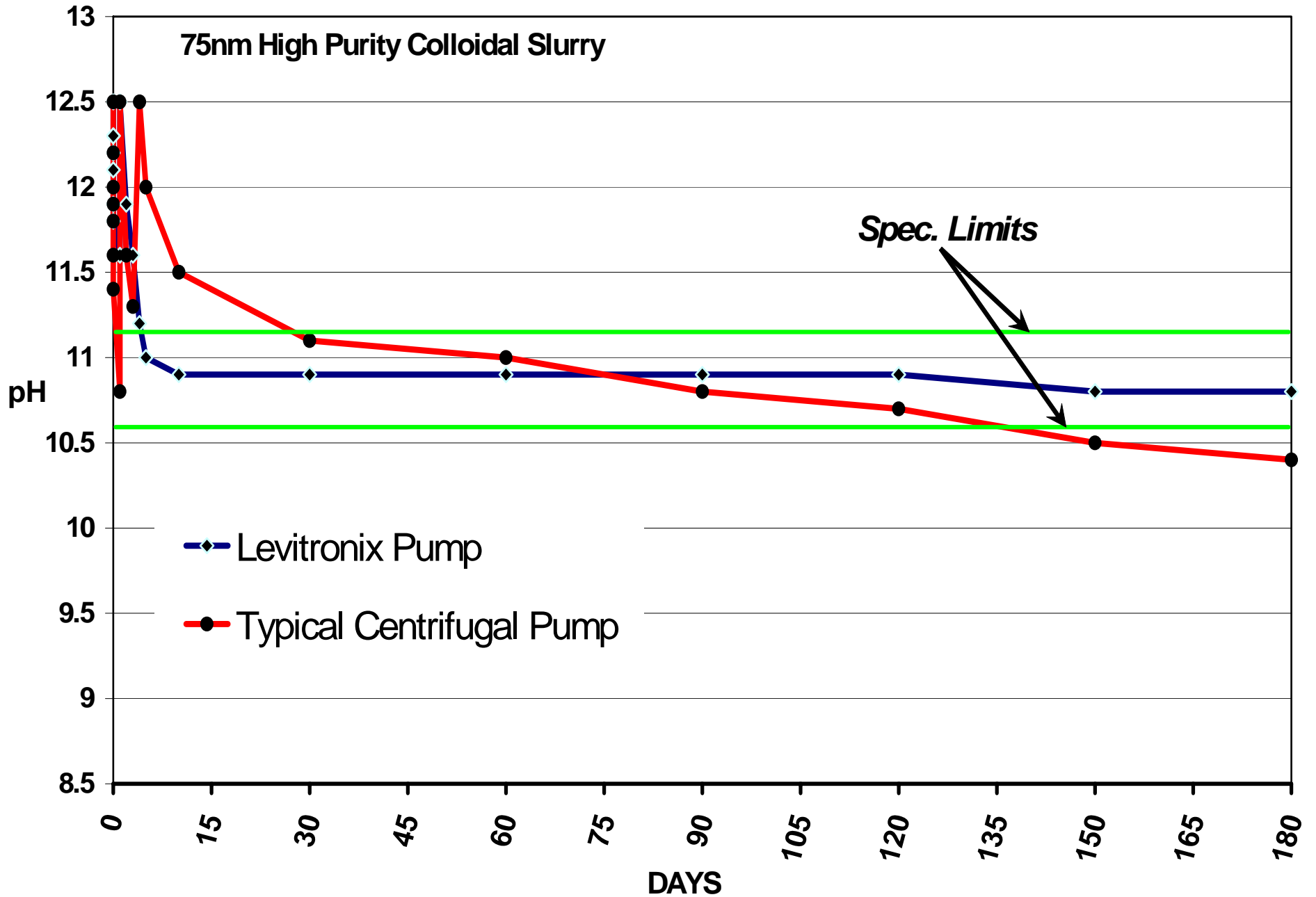
SEE NEXT SLIDE....

pH Stabilization Process at Silco



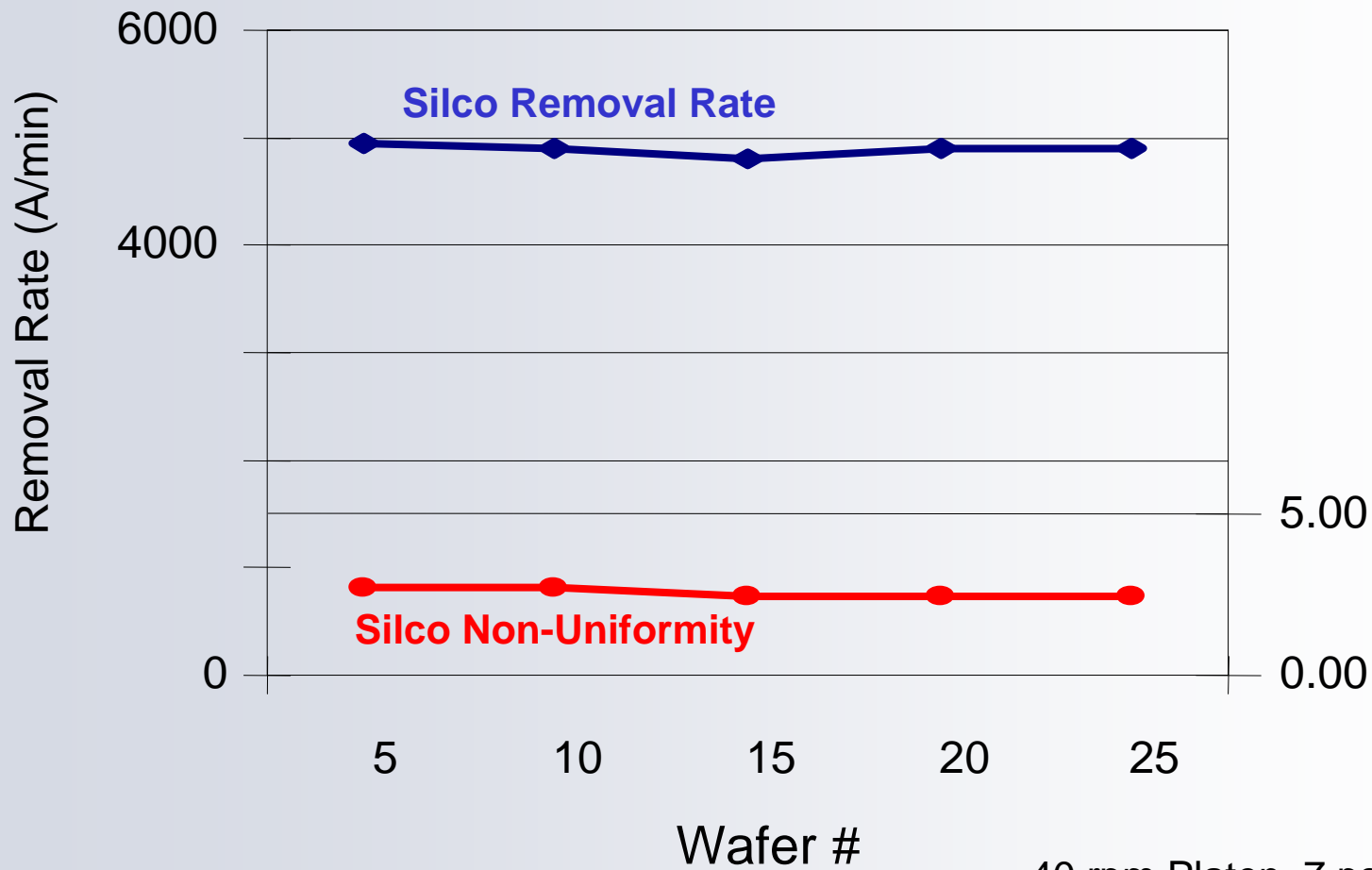
pH Stabilization Study

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Removal Rate and Non-Uniformity

25 wafer baseline



40 rpm Platen, 7 psi

Concentration in ppb**Detection Limits
(ppb)****Slurry, EM 7530K
Lot# UF 148
1/4/2007**

Aluminum	(Al)	5	270
Barium	(Ba)	1	3.3
Calcium	(Ca)	10	22
Chromium	(Cr)	5	<5
Copper	(Cu)	5	<5
Iron	(Fe)	10	58
Lead	(Pb)	5	<5
Magnesium	(Mg)	5	36
Manganese	(Mn)	5	<5
Molybdenum	(Mo)	5	<5
Nickel	(Ni)	5	<5
Niobium	(Nb)	5	<5
Potassium	(K)	10	820,000
Sodium	(Na)	10	9,500
Thallium	(Tl)	1	<1
Tin	(Sn)	5	<5
Titanium	(Ti)	5	<5
Zinc	(Zn)	5	<5
Zirconium	(Zr)	1	230

Summary

- A New Class of Oxide Slurry
 - pH-Stable CMP slurry products
 - Less agglomeration, gel Issues
 - More consistent CMP processing
 - Purity approaching TEOS-based slurry
 - Happier end-users

Silco Staffing

- Karey Holland, PhD – Chief Technologist
- Steve Holland, PhD – Dir. Of Marketing
- Bob Small, PhD – Senior Advisor
- Bill Mullee – General Manager

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