



Meeting the SiC Gold Rush with Entegris Capabilities

Niraj Mahadev

Vice President and General Manager

Substrate Business

Current SiC Industry Challenges



1. CAPACITY



3 Manufacturing in U.S. and Taiwan; expand to other regions



Technologies to enable increased productivity



Slurries and Cleans



CMP Pads



Wafer Handling



Gas Purifiers



PVA Brushes



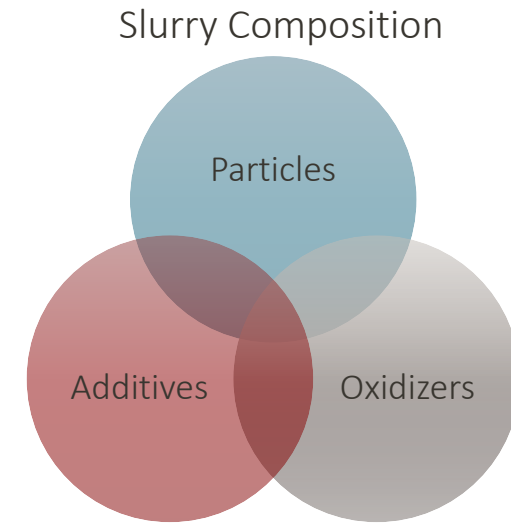
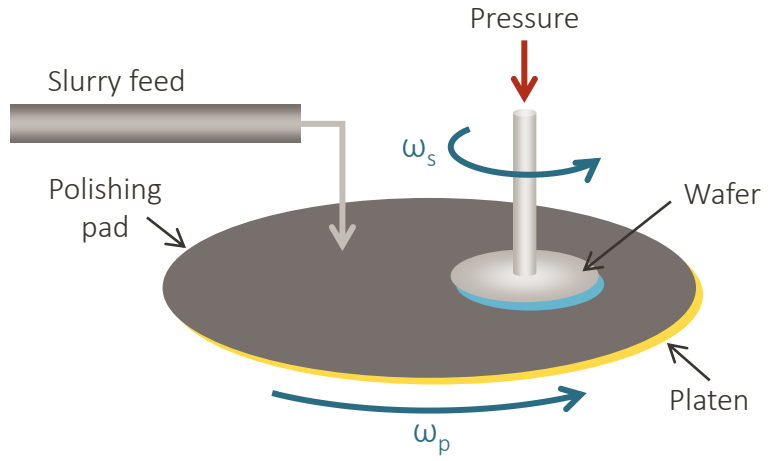
2. QUALITY



3. COST OF OWNERSHIP

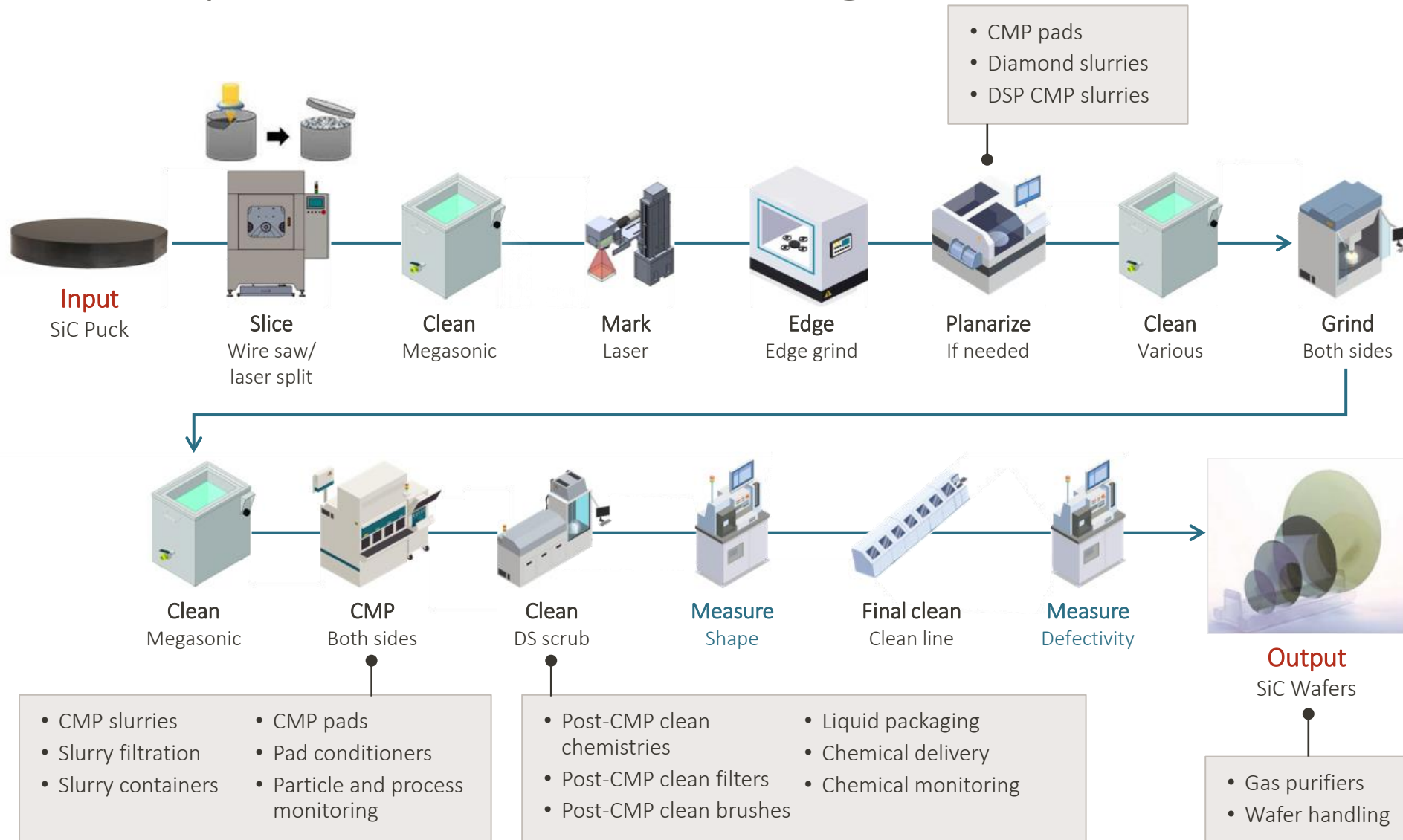


CMP (Chemical Mechanical Polishing)



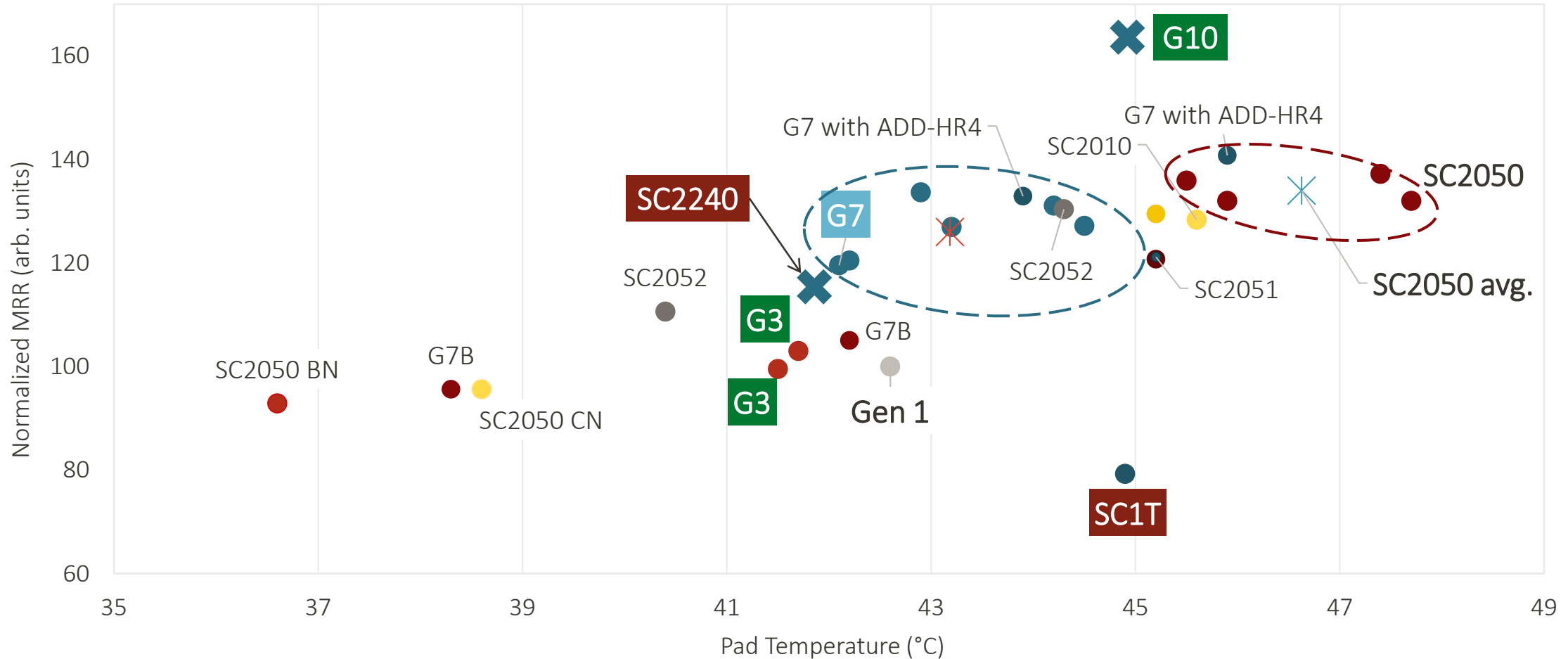
	Material	Hardness Knoop (kg/mm ²)	Chemical Action
Super-hard materials	Silicon carbide	2150–2900	Highly inert
	Gallium nitride	1580–1640	Inert
	Sapphire	2000–2050	Inert
	Diamond	8000–10,000	Highly inert
IC materials	Amorphous silica	<700	Reactive
	Copper	<300	Highly reactive

Process Sequence for SiC Wafering

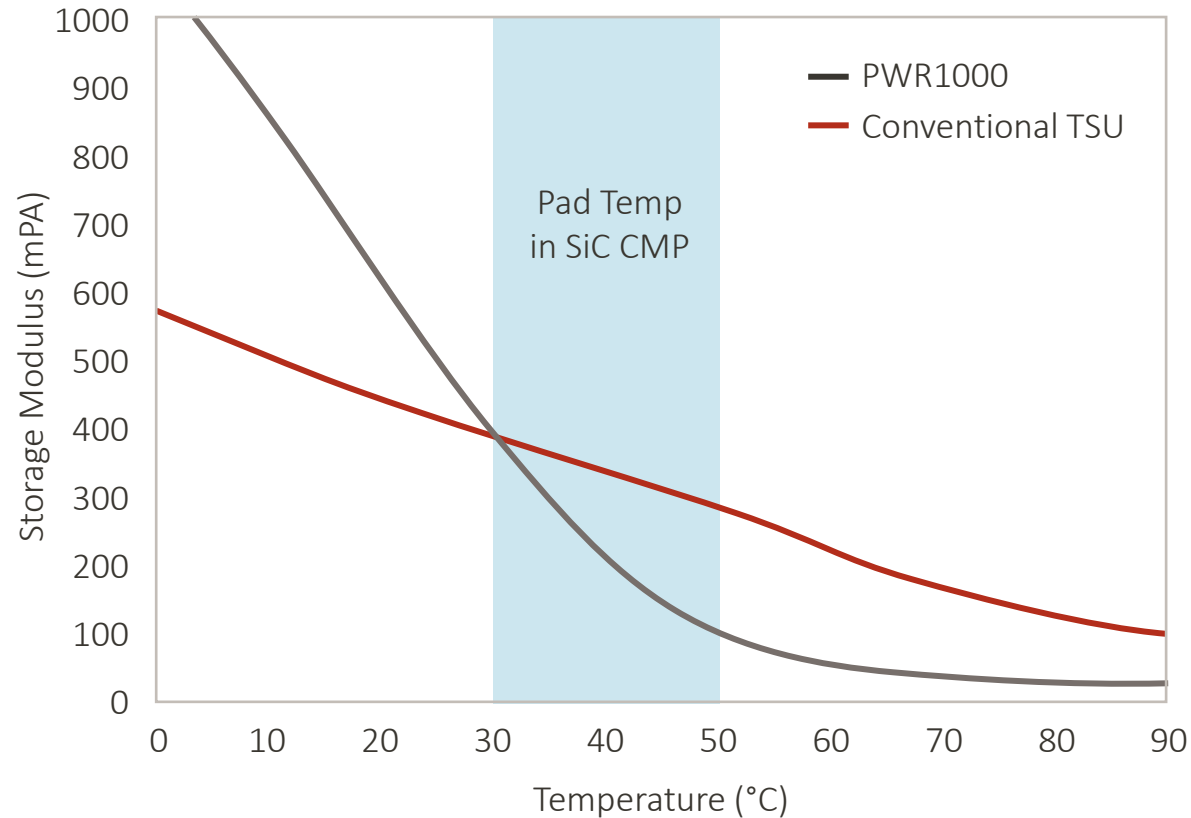


Slurries Technology Development: Productivity Increase

RR vs. Temperature Profile



Pads Technology Development: Performance



Cost of Ownership

- 2-3× higher pad life compared to softer pads
- Higher slurry retention on pad surface with optimized groove pattern

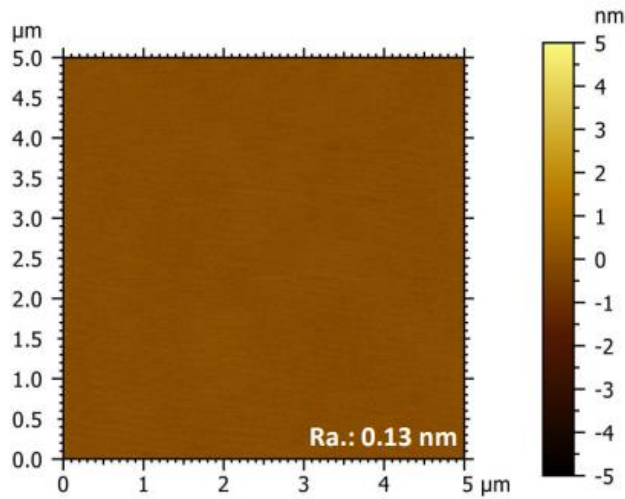
Higher Throughput

- 15-30% removal rate increase compared to softer pads on GigaMat batch polisher
- >50% decrease in tool downtime due to reduction on pad change frequency

Higher Wafer Yield

- Scratch reduction
- Less metal contamination

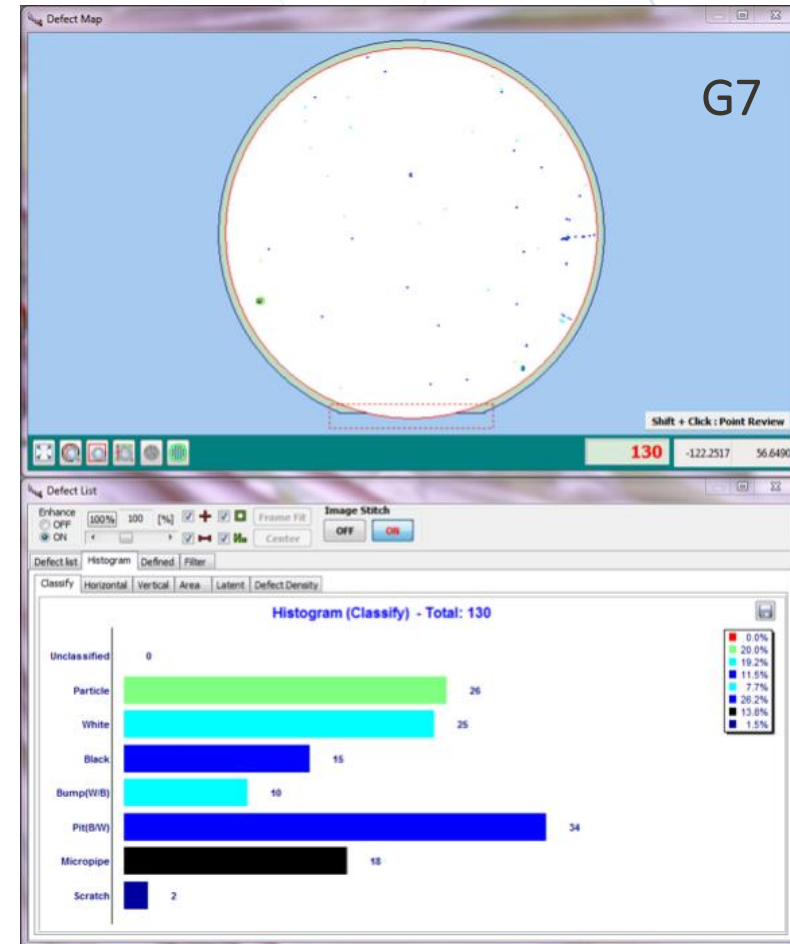
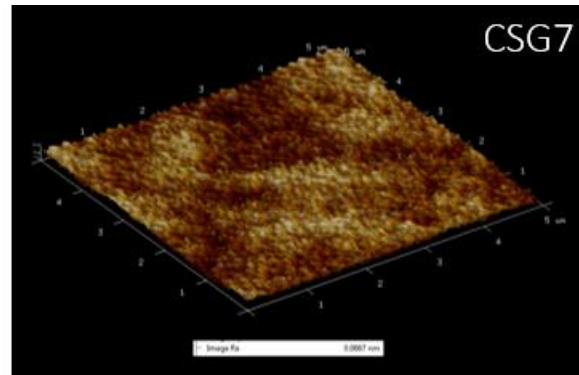
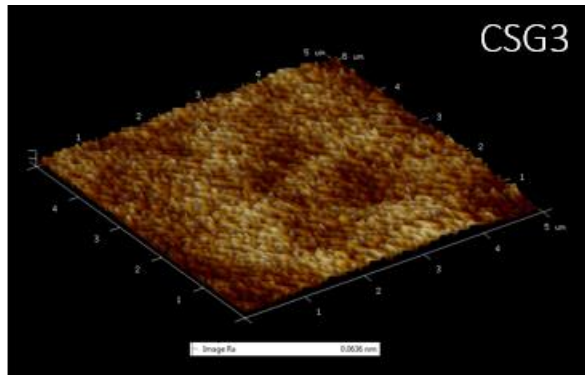
Slurries Quality Matrix: Roughness/Scratches



SC1(T)

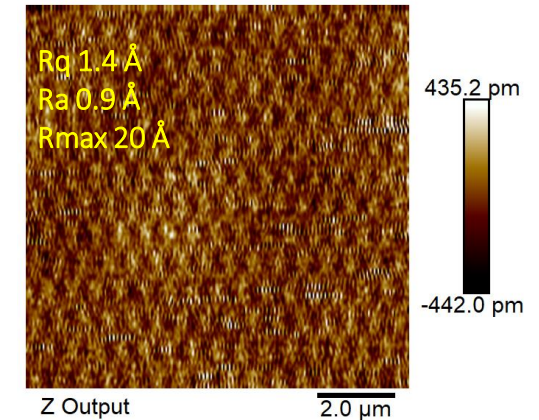
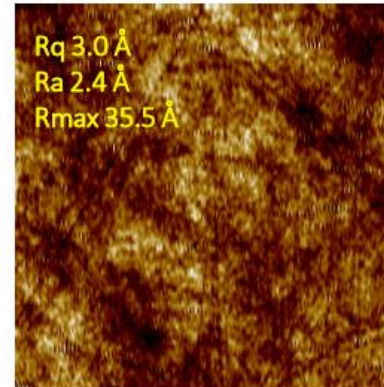
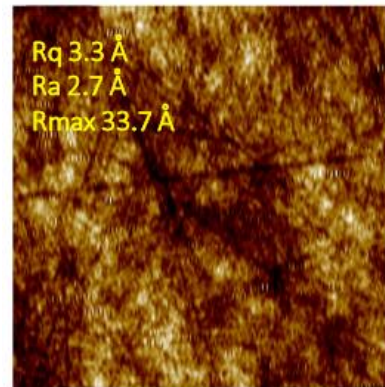
Si-Face

Product	Ra (nm)
Micropol CS G3	0.0636
Micropol CS G7	0.0667



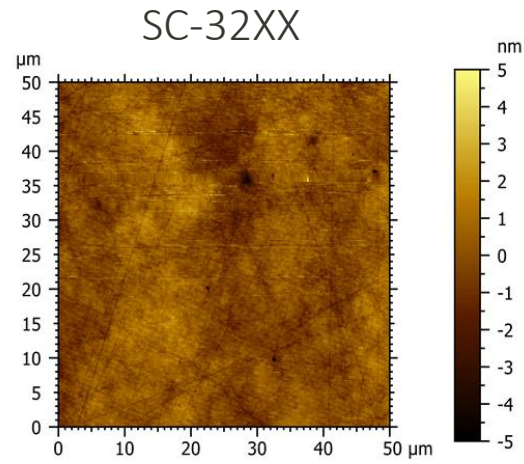
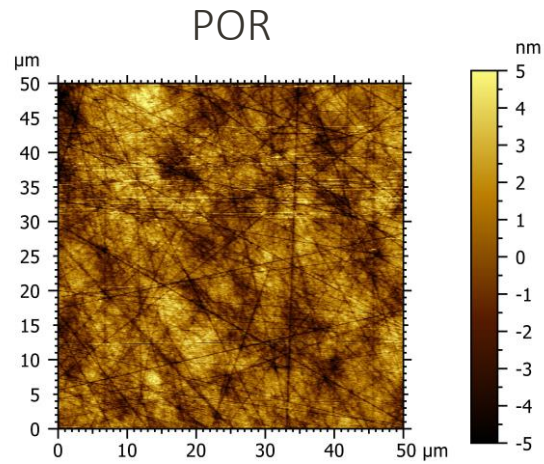
Slurries Quality Matrix: Superfinishing C-Face Slurries

Slurry	Traditional SiC polishing chemistry	High-C surface finish Permanganate BKM	New high-C surface finish slurry
RR ($\mu\text{m/hr}$)	5.7	4.7	1.8
C side surface roughness Ra ($\text{\AA}$)	2.7	2.4	0.9

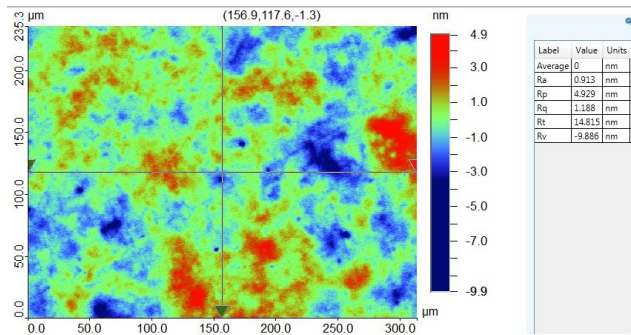
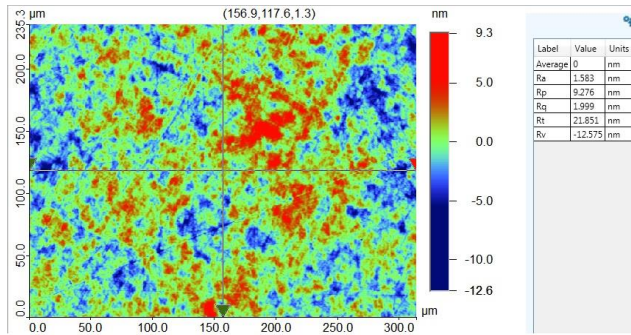


Next-gen slurry to provide excellent C-face roughness ($\text{Ra} < 1 \text{ \AA}$)

Slurries Quality Matrix: Superfinishing Poly SiC Slurries



10 × 10



300 × 300

Next-gen slurry developed to provide excellent roughness ($R_a \sim 0.4 \text{ nm}$) and no grain highlighting with high throughput ($RR > 3 \text{ } \mu\text{m/hr}$) on 6" wafers at 5.6 psi

Key Takeaways

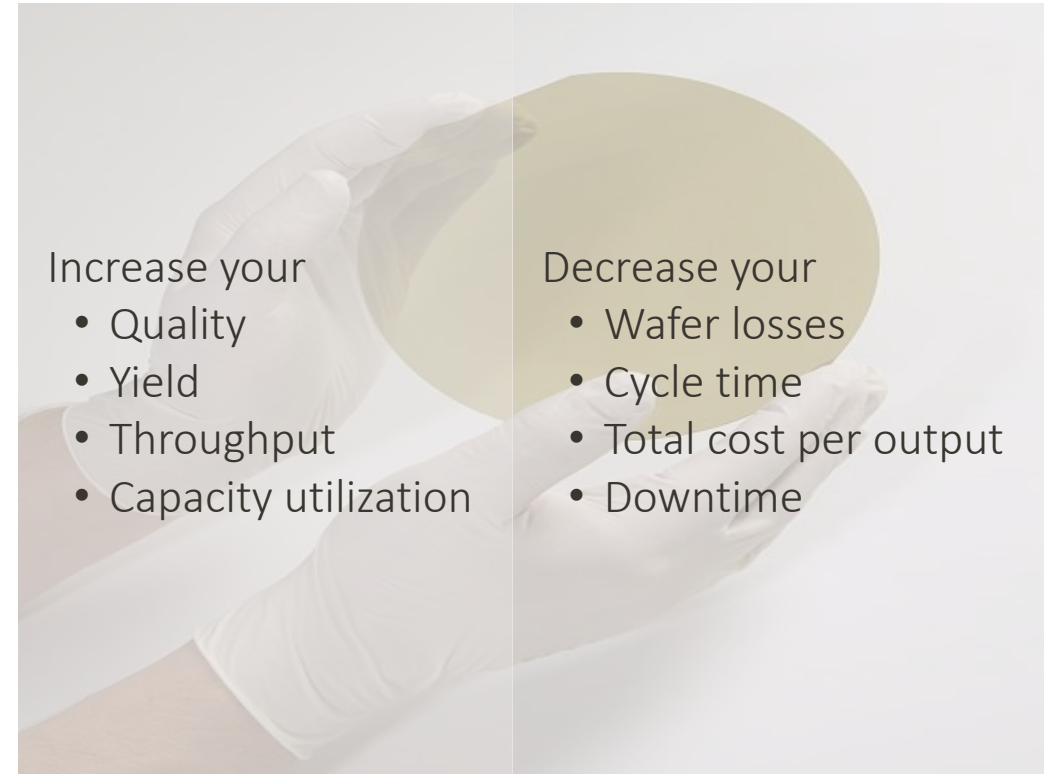
This full ecosystem approach provides innovation and differentiation

Performance Leader

- Used by SiC industry leaders
- Drop-in process improvements
- Industry-leading MRRs, surfaces, and yields

Best Value

- Competitive pricing
- Global support
- Large and stable supplier
- Reputation for purity and quality





Thank you!

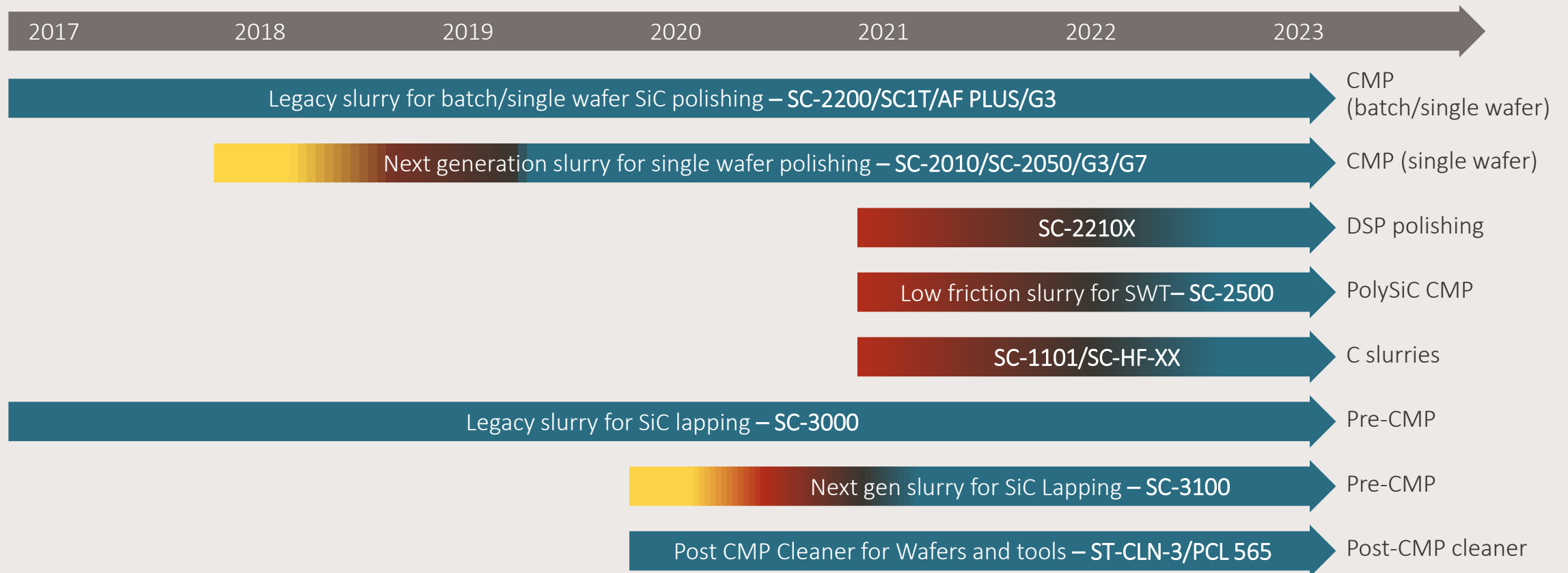
Thank you!

Q&A

Appendix



SiC Technology Slurries Platforms



Feasibility

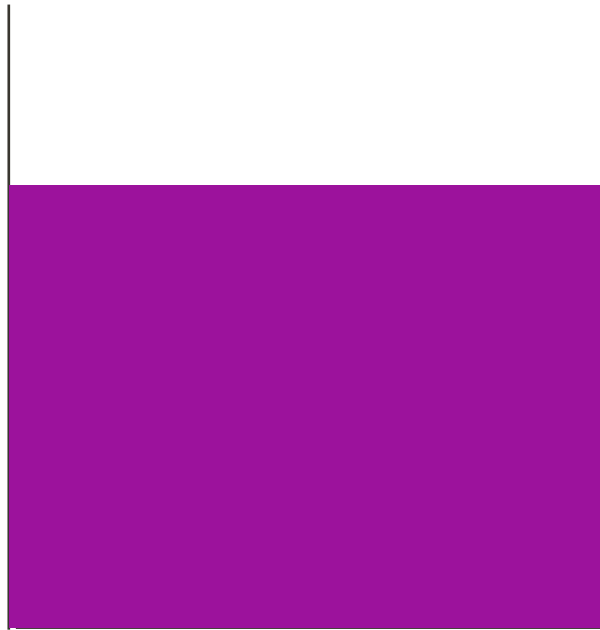
Development

Beta Development
(LVM)

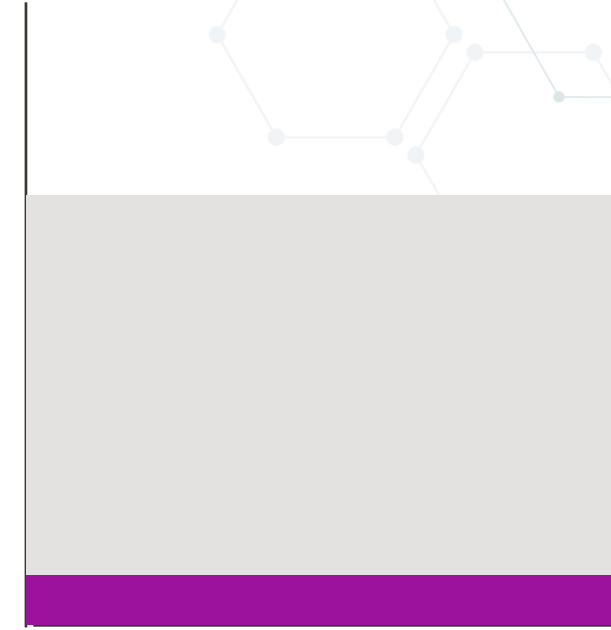
Commercial

Entegris Commitment to Sustainability and Waste Minimization

Entegris is working on developing solutions to partner with customers on Permanganate waste treatment to **minimize** hazardous waste disposal



Waste Treatment Process



Non-Hazardous waste