DuPont Electronics & Imaging

Advance of Oxide Post-CMP Clean Process: A Total Solution toward Superior Clean Performance

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1. Introduction

Oxide (silica) removal is one of the most time- and cost-consuming applications in FEOL chemical mechanical planarization (CMP) processing. Recently, positively-charged silica has emerged as an advantageous direction in CMP processing with a lower cost of ownership. With tailored surface engineering on the abrasives, this kind of slurry can greatly enhance the interaction between the abrasive and the surface to be polished, eliminating solid content at point of use. However, the enhanced affinity (and thus removal rate) of positively-charged silica for the polished surface makes post-CMP cleaning challenging, and commodity chemistry-based cleaners are ineffective at addressing this issue.

2. Technical Challenge

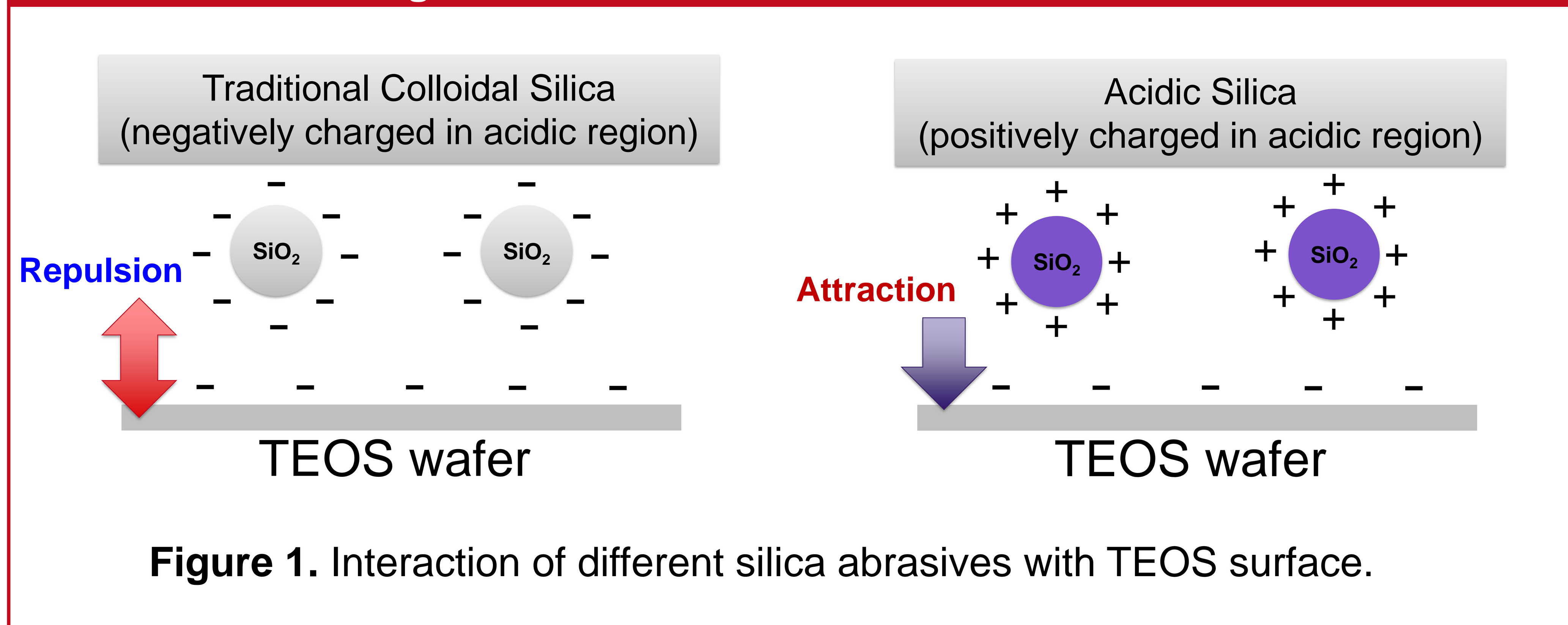


Figure 1. Interaction of different silica abrasives with TEOS surface.

3. Cleaning Principle

Strong repulsive force results in excellent performance

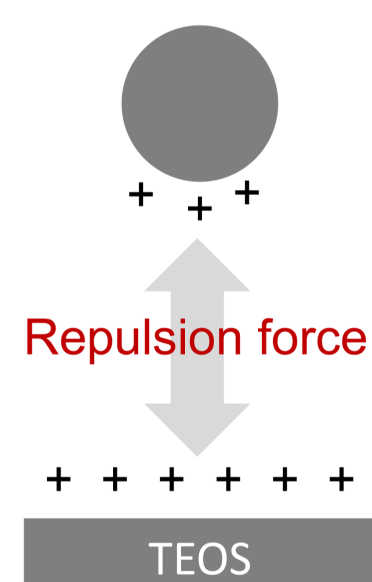
EKC-5710 induces a strong electrostatic repulsion between the TEOS/SiN surface and the slurry particle.

Surface charge Z.P. on various substrates [mV]

Substrate	TEOS	SiN
Surface charge Z.P. [mV]	+16	+34

Surface charge Z.P. on abrasive [mV]

Particle	(Positively-charged colloidal SiO2 abrasive)*
Surface charge Z.P. [mV]	+3.5



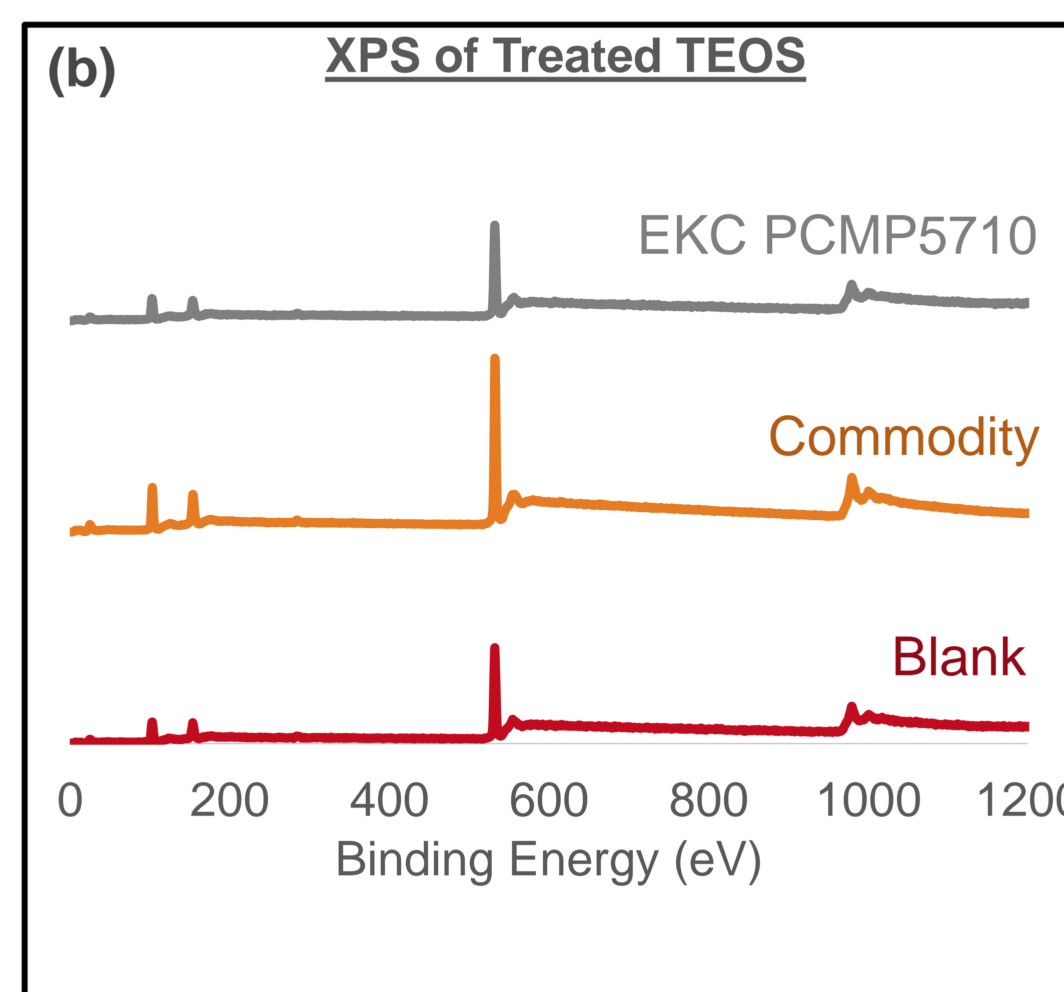
4. PCMP Cleaning Evaluation

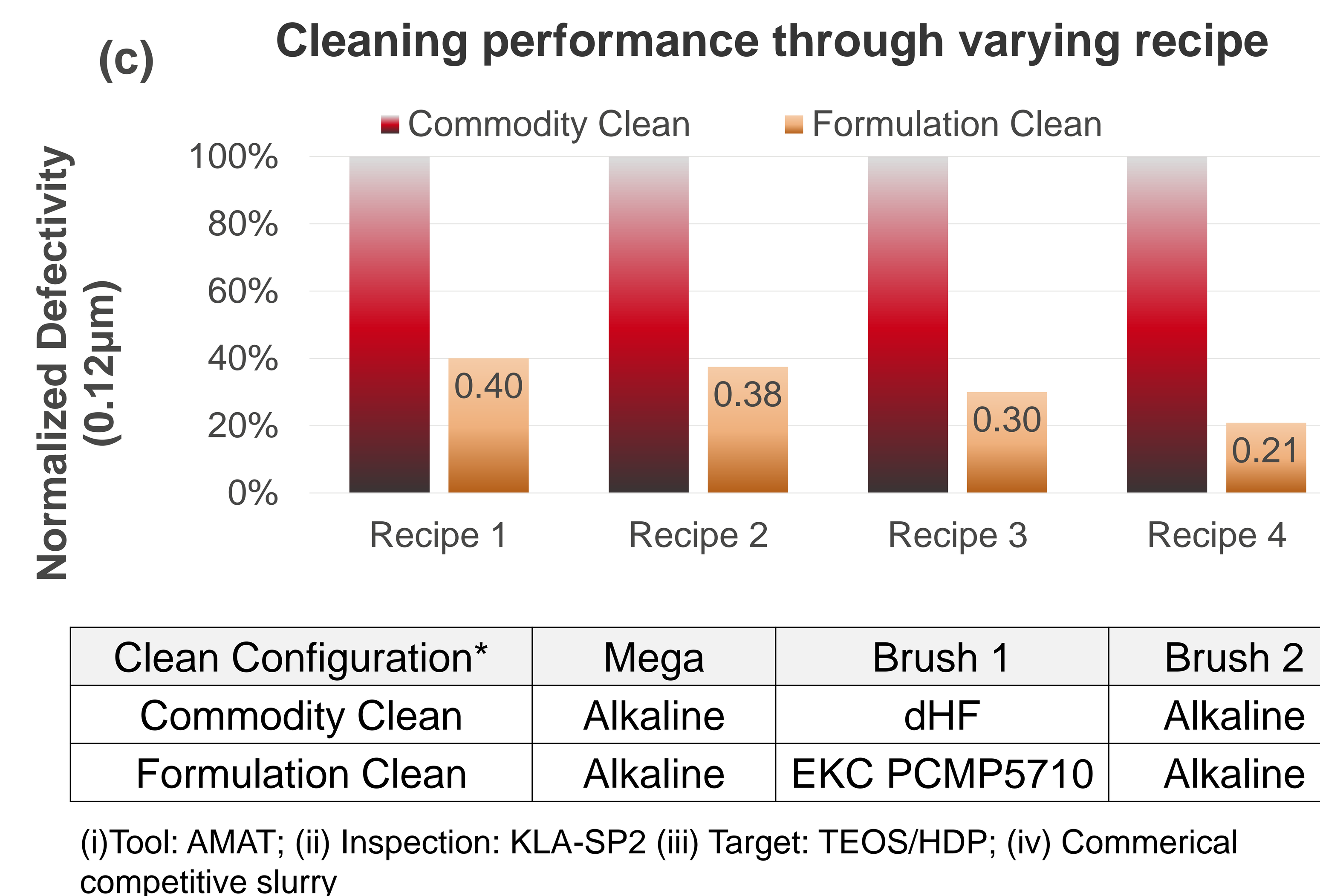
(i) Great material compatibility with dielectric surface
(ii) No organic residue/contamination
(iii) Broadened cleaning window versus commodity chemistry

EKC PCMP5710 provides a total solution to PCMP processing of acidic/positively-charged silica slurries.

(a)

	Cleaner	TEOS	SiN	PolySilicon
Compatibility (Å/min)	dHF (0.5%)	63	3	<1
	EKC PCMP5710	<1	<1	<1





Clean Configuration*	Mega	Brush 1	Brush 2
Commodity Clean	Alkaline	dHF	Alkaline
Formulation Clean	Alkaline	EKC PCMP5710	Alkaline

(i)Tool: AMAT; (ii) Inspection: KLA-SP2 (iii) Target: TEOS/HDP; (iv) Commerical competitive slurry

Figure 2. (a) Material compatibility of commodity chemistry and EKC PCMP5710; **(b)** Surface analysis of wet-cleaned TEOS wafer; **(c)** PCMP cleaning performance on positively-charged silica CMP.

5. Conclusions

Positively-charged silica CMP has been widely applied for interlayer dielectric (ILD) and shallow trench isolation (STI) processing, as the acidic silica abrasive provides higher TEOS removal efficiency. However, the electrostatic attraction poses a technical challenge in PCMP cleaning. Incorporating tailored surface engineering on the positively-charged silica and TEOS surface, EKC PCMP5710 enables a strong repulsive force and prevents particle redeposition during the PCMP cleaning process. In addition, EKC PCMP5710 provides both promising dielectric compatibility without organic residue/contamination left on the cleaned surface and a significantly broadened working window compared with commodity chemistry. EKC PCMP5710 substantially reduces defectivity, demonstrating a significant development toward the low cost of ownership for the FEOL CMP process.

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