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Laser Edge Cleaning Process and System

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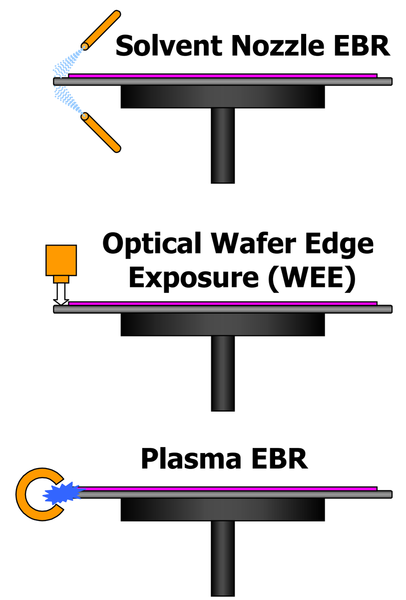
UVTech Systems

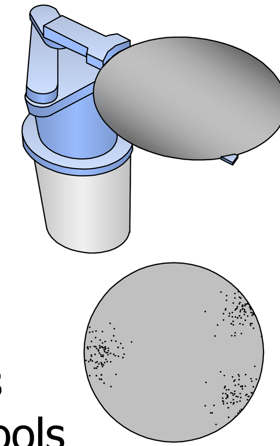
Current Edge Cleaning Methods



- Complex processes
- High chemical & equipment costs
- Impacts die yield
- Difficulty removing multiple films
- Limited edge exclusion control & resolution

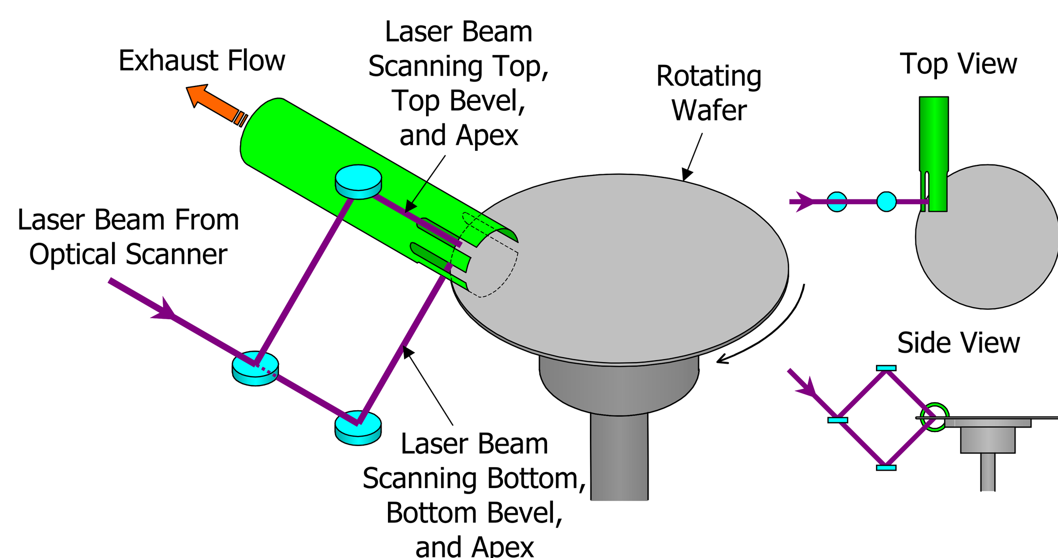
Problems Caused by Untreated Wafer Edges

- Particle transfer in immersion lithography
- Wafer transport creates particles
- Particles from post-etch residues and CMP
- Untreated metal on edges causes arcing in plasma tools



Laser Edge Cleaning

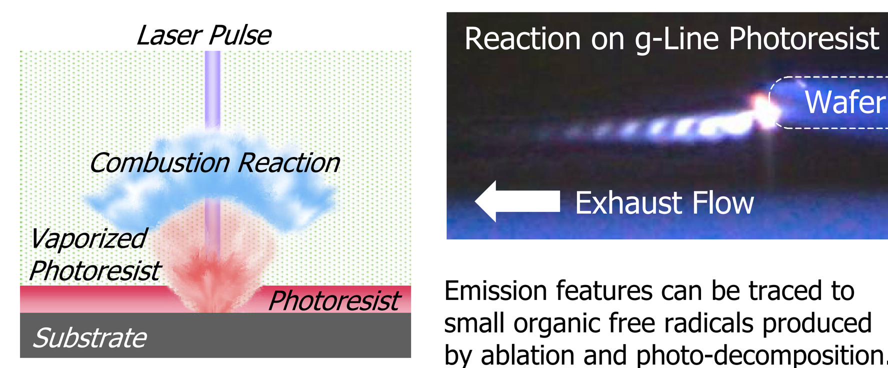
LEC-Alpha



- Uses angled laser beams
- Cleans all wafer edges (top, apex, bottom, & bevels)
- 200mm or 300mm wafers
- 355nm pulsed laser
- Atmosphere environment
- Ambient temperature

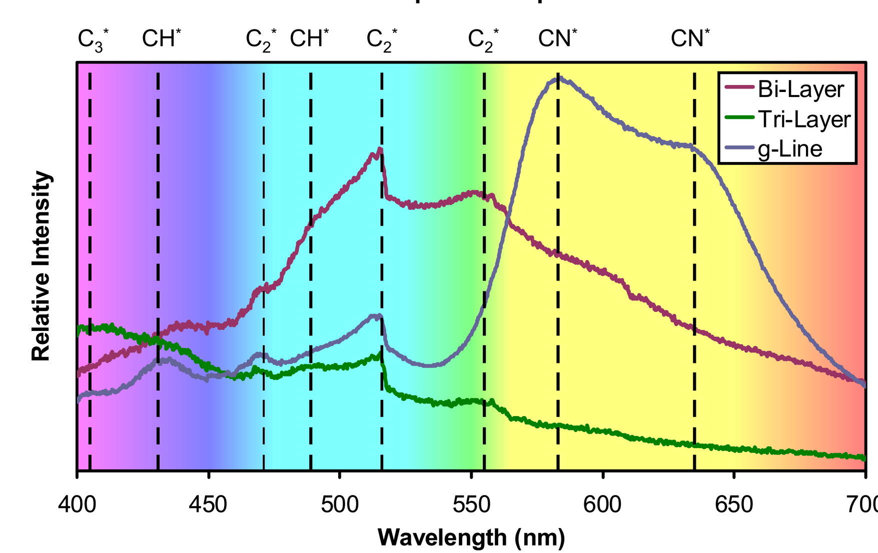
LEC-Alpha

Reaction Mechanism

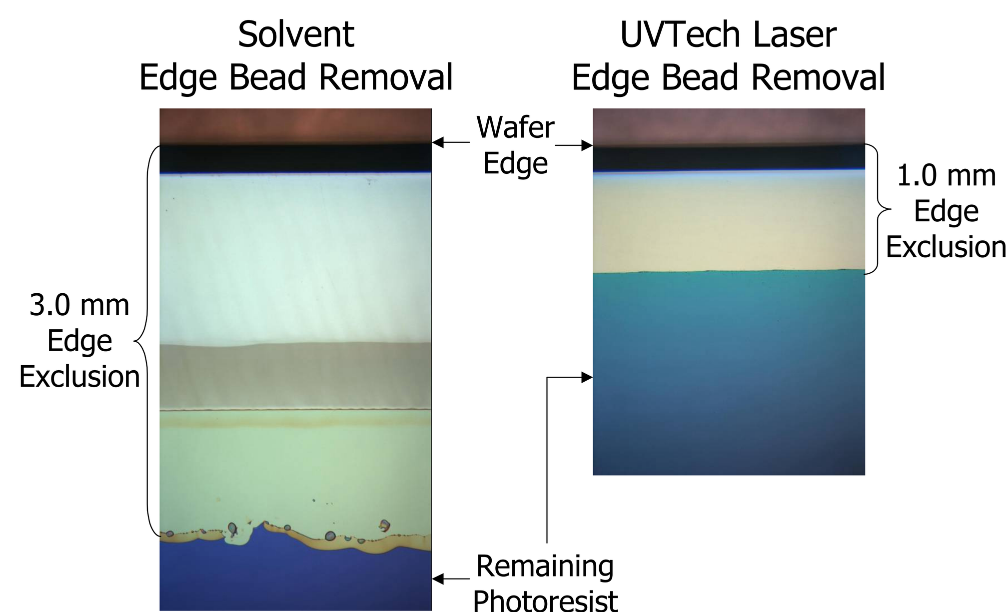


Emission features can be traced to small organic free radicals produced by ablation and photo-decomposition.

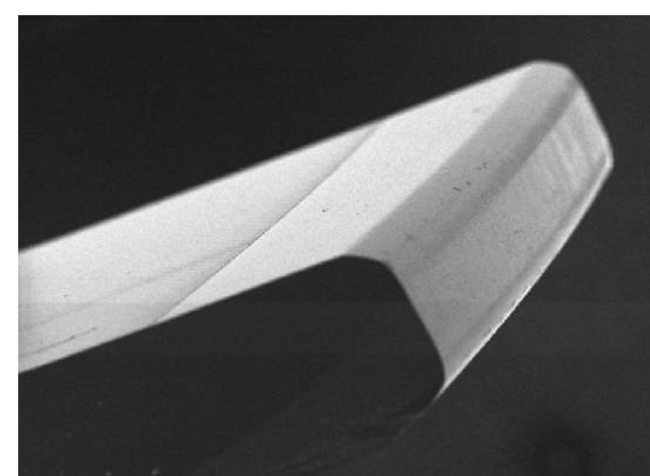
Visible Light Emission Spectra Of Three Different Photoresists



Solvent vs. Laser Tri-Layer Film Stack EBR



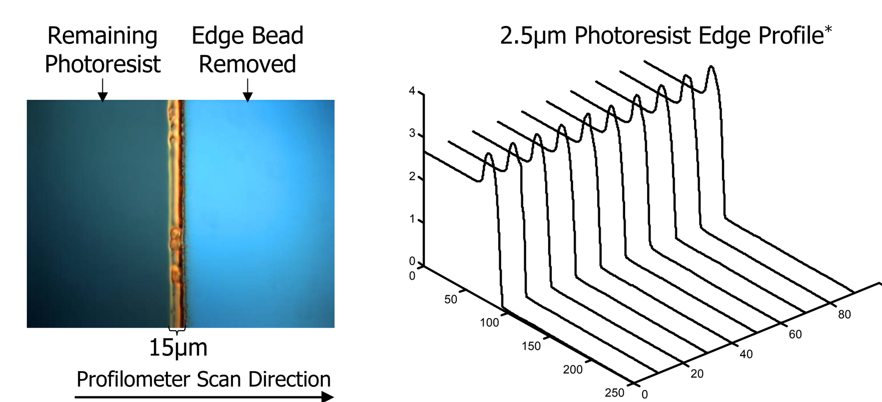
Photoresist Edge Bead Removal



- Photoresist Thickness ~ 7,000Å
- Cleaning Time ~ 10 seconds
- Processed on LEC-Alpha Laser Edge Cleaning System

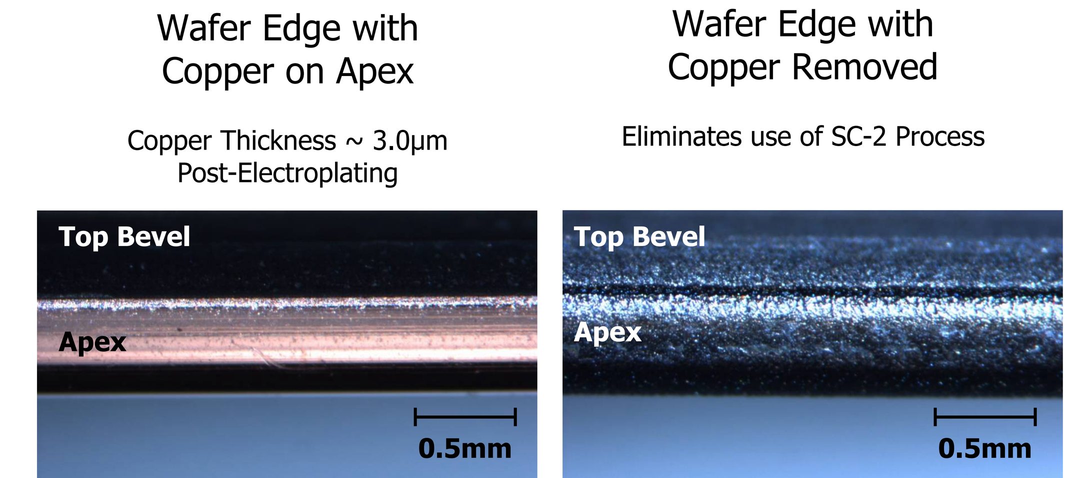
Applications

Photoresist Edge Bead Removal

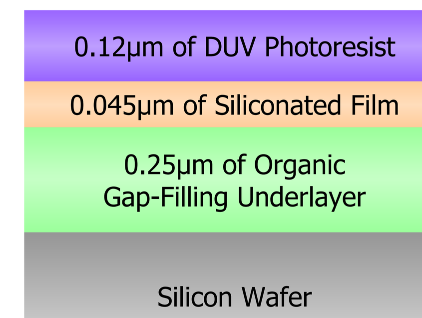


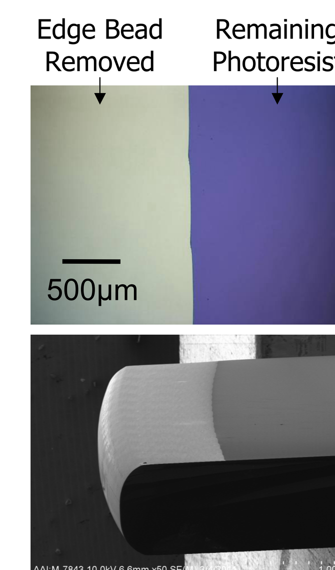
The LEC-Alpha removes this film stack at a rate of ~ 5 s/mm of edge exclusion width.**

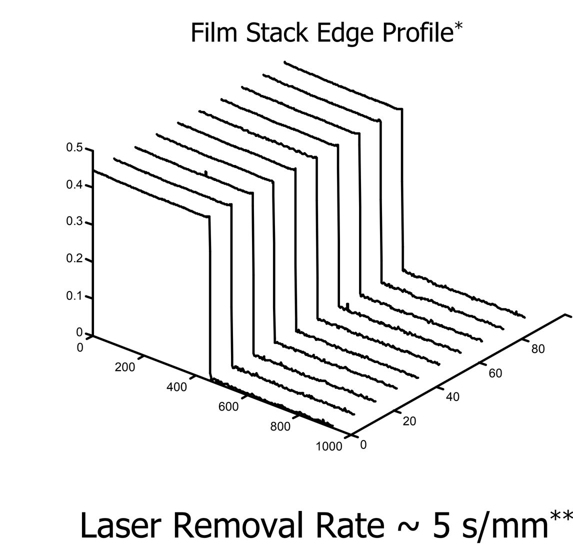
Copper Removal



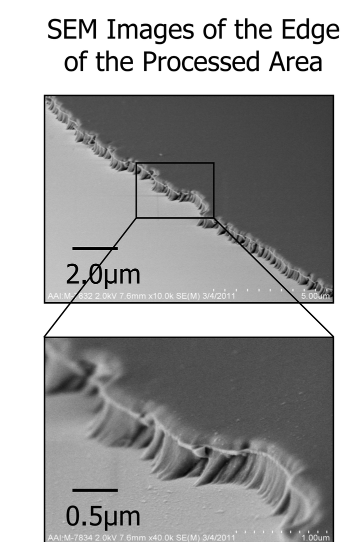
Tri-Layer Film Stack Removal

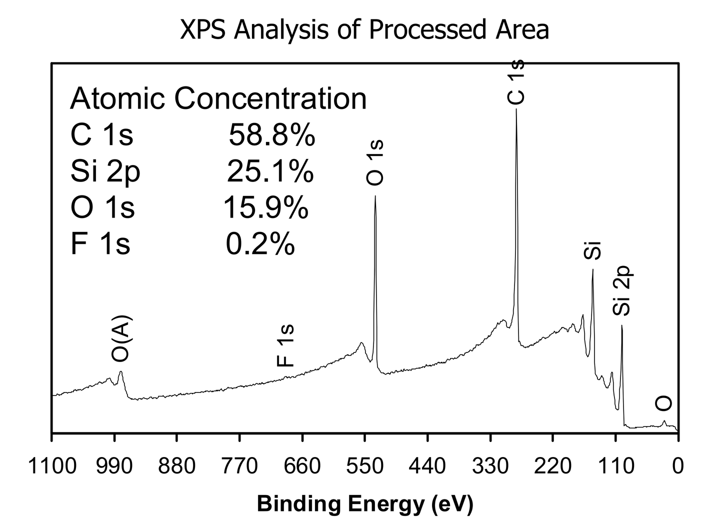




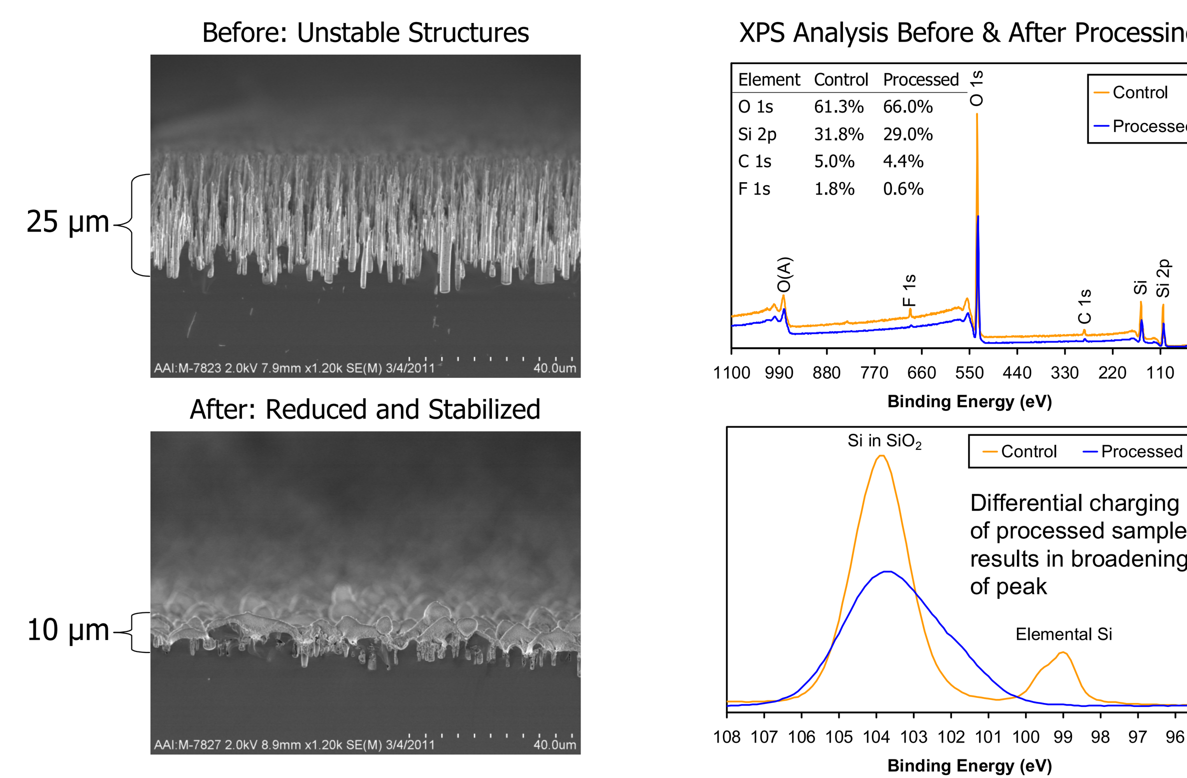


Laser Removal Rate ~ 5 s/mm**

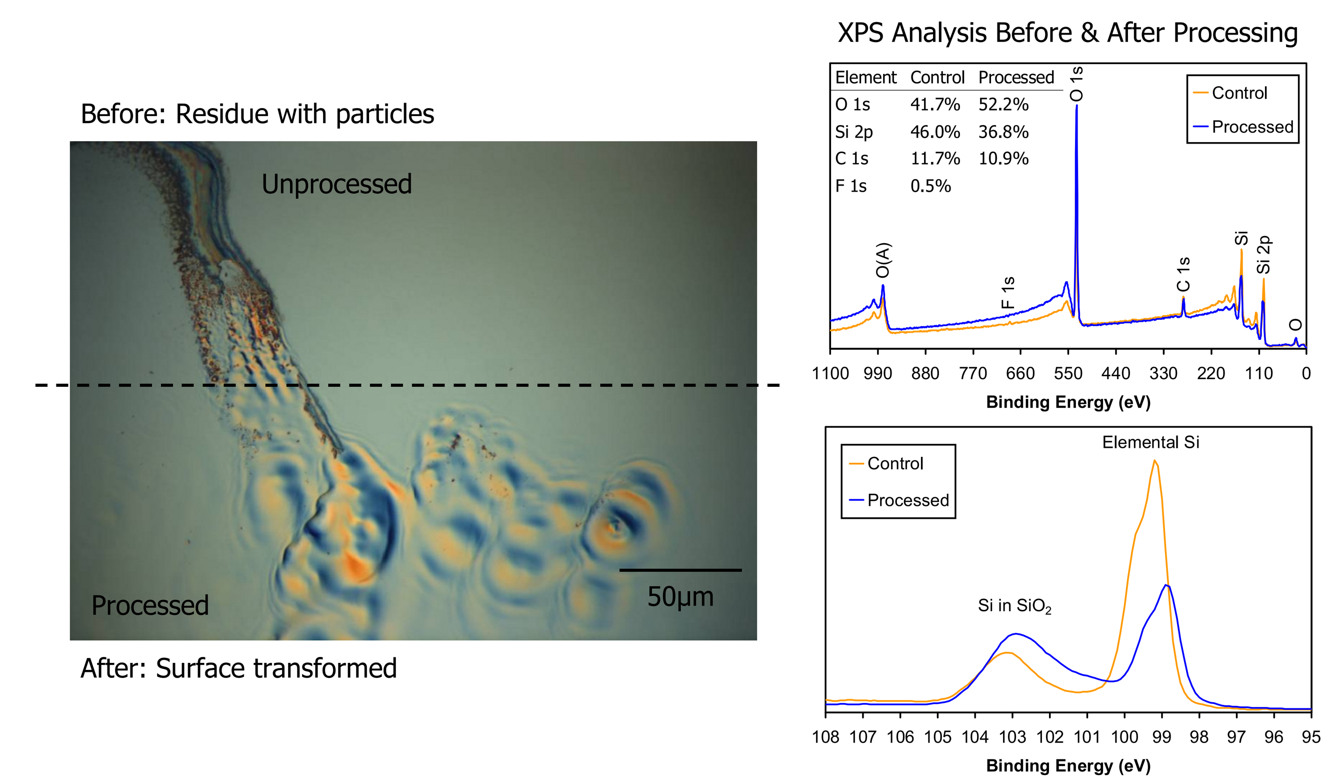




Post-Etch Black Silicon Treatment

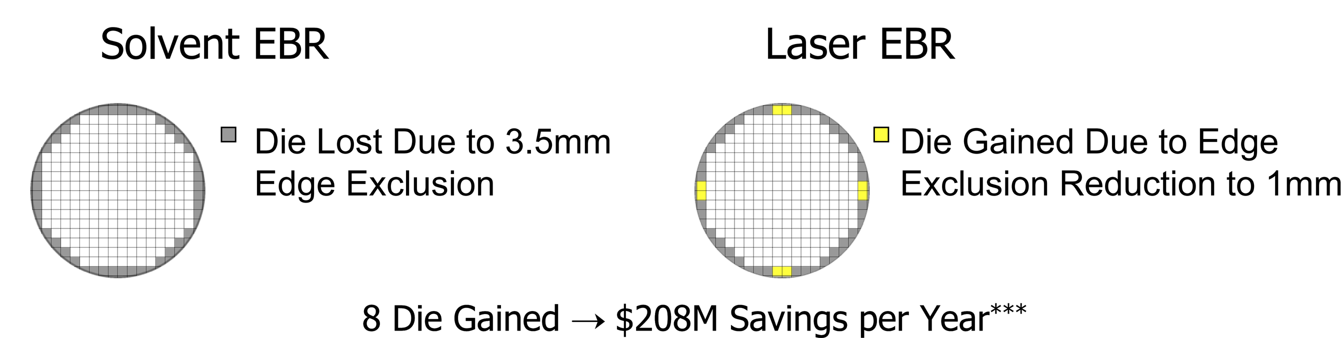


CMP Slurry Residue Processing



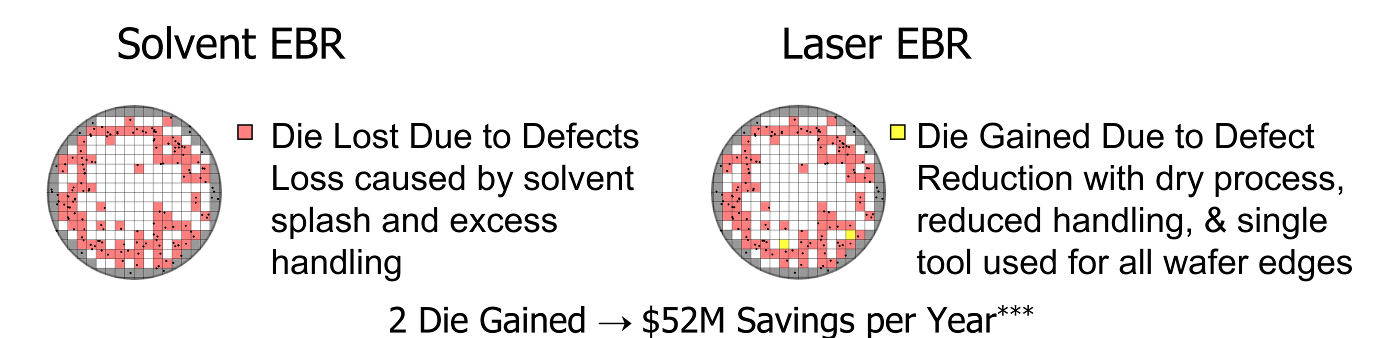
* KLA-Tencor P-15 Profilometer ** Process Dependent

Yield Increase from Edge Exclusion Reduction



8 Die Gained → $208M Savings per Year***

Yield Increase from Defect Density Reduction



2 Die Gained → $52M Savings per Year***

Data provided by George Deltoro, Silicon-Pacific Technical Consulting.
Die layout based on an Intel Core i7-975 microprocessor
*** Savings based on $50 per die, 10,000 wafer starts per week, 52 weeks per year

Benefits of Laser Edge Cleaning

- Wafer edges (top, apex, bottom, & bevels) cleaned in a single step
- Uses no chemicals or water, produces no waste, requires no treatment or disposal
- Operates at ambient temperature & pressure
- Programmable edge exclusion: 0.1 to 25mm ±0.1mm
- Potential increase in die yield
- Removes copper, post-etch polymer, tri-layer stacks and photoresist films
- Stand-alone or integrated (tracks, clusters, etc.)
- LEC-300 System designed for throughput of up to 120 WPH (process dependent)

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