

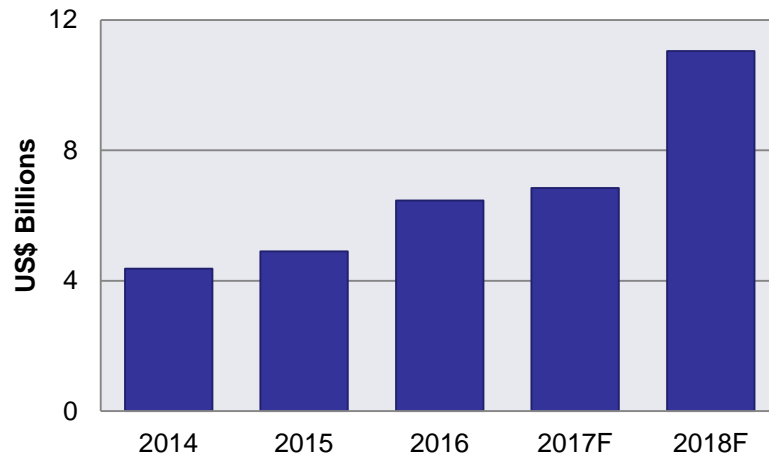
FEOL photo track technology: latest trends and development

Xinglong Chen, CTO, Kingsemi

Domestic FEOL photo track market

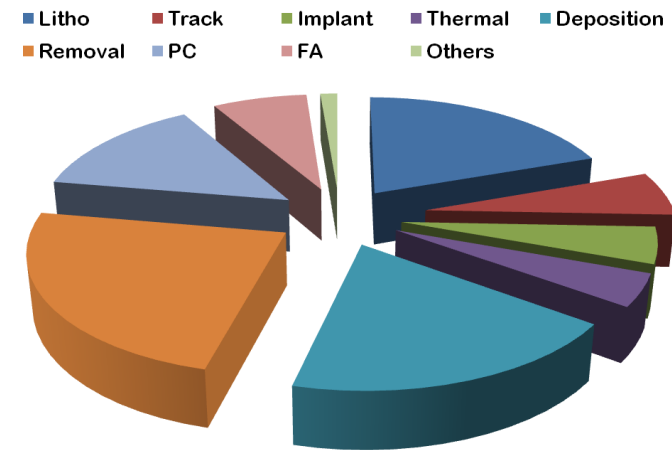
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China semiconductor equipment market

Source: SEMI, 2017



WFE market segments

- China fab boom brings domestic equipment market to over \$10 Billions in 2018
- Photo track equipment market will grow with it, what is there for domestic suppliers?

Node shrinkage and productivity/yield requirement continue to drive photo track technology improvement

- Faster – higher throughput follows photolithography tool improvement
- Cleaner – more stringent spec for defects/PC
- Flatter – tighter WIW uniformity and edge excursion
- More tolerable – adapt to large wafer warpage
- Smarter – self diagnostics and self calibration
- Friendlier – more intuitive user-interface, easier PM process

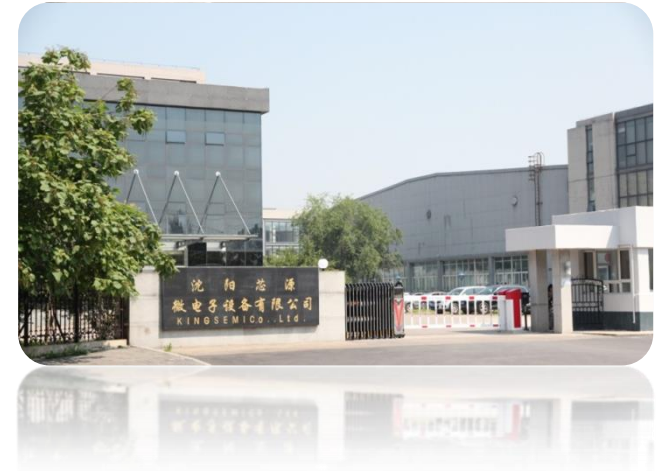
In the light of these ever challenging requirements, what are domestic suppliers doing?

KingSemi Profile

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- Founded and headquartered in 2002 at Shenyang with branches at Shanghai, Guangzhou, and Taiwan
- Leading domestic photo track company, led photo track projects of national 11th and 12th 5-year plan
- Serviced markets: photo track for LED, bumping, advanced packaging and FEOL
- Fully-equipped R&D labs for hardware design and process verification
- In-house manufacturing capability
- More than 200 employees, annual sales of 200M RMB with annual growth rate >20%
- IP portfolio includes over 300 patents in China and US



KingSemi Profile

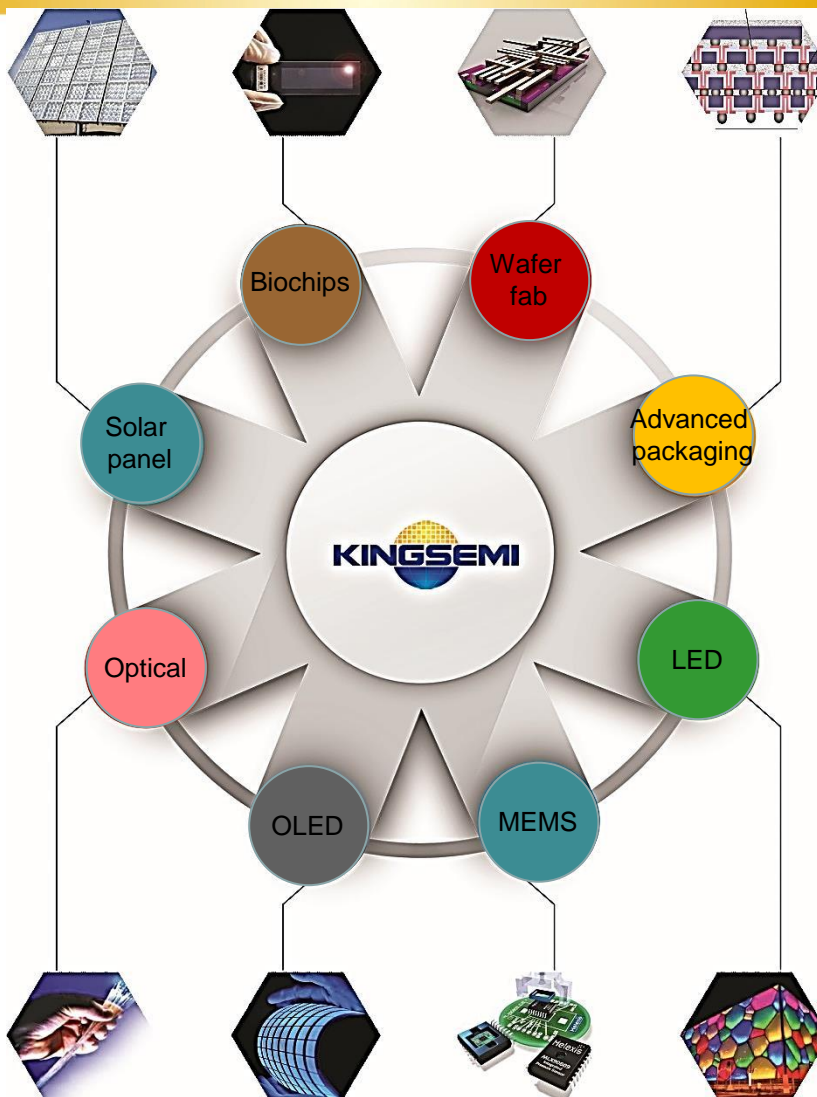
- Coater/developer portfolio and serviced markets

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FEOL photo track
300mm/200mm



Spray Coater
300mm/200mm



COT/DEV for advanced packaging
300mm



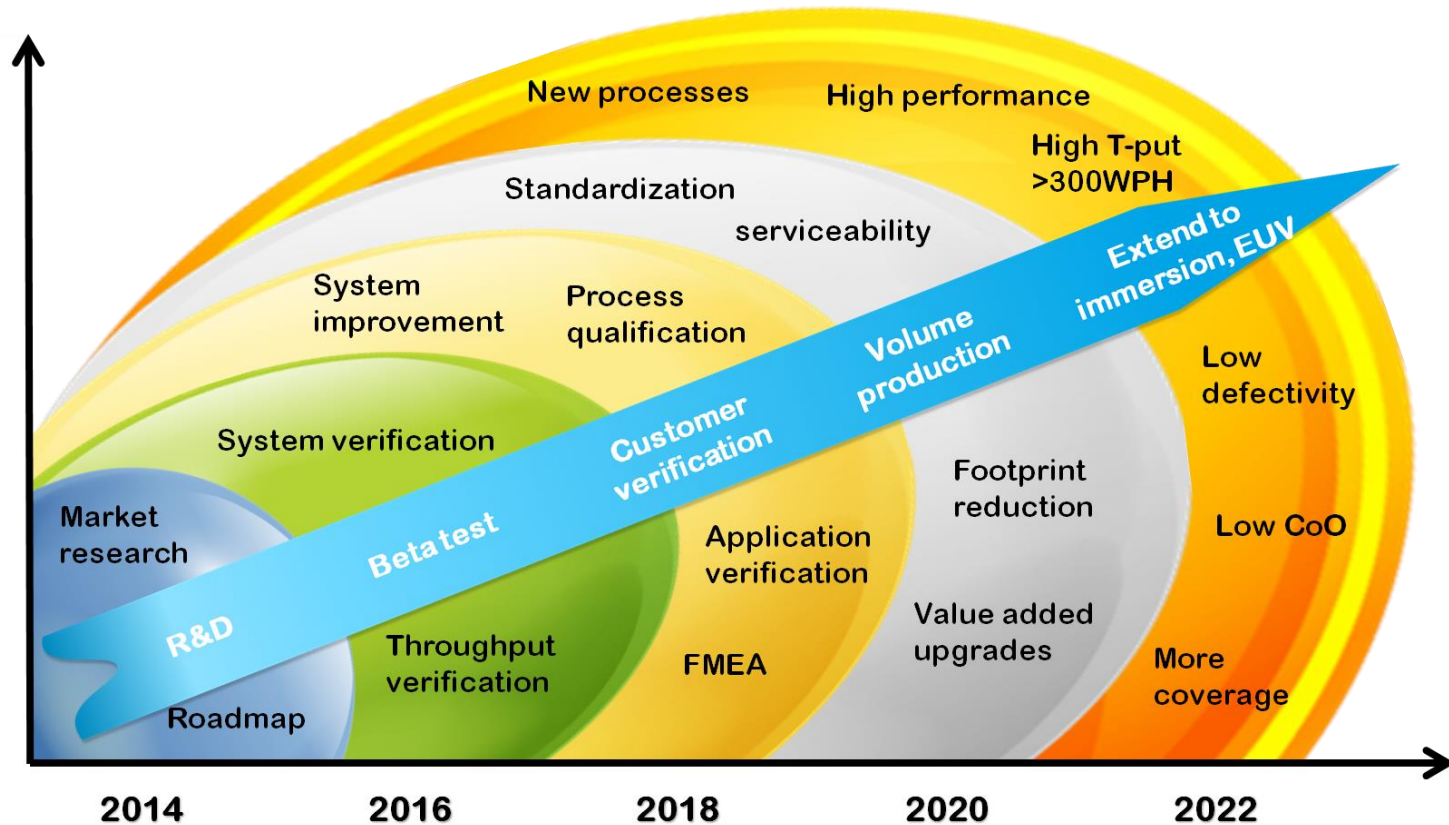
COT/DEV for LED
100mm-200mm

Kingsemi FEOL photolithography track

- Technology roadmap

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Based on a fully extendable platform, Kingsemi photo track products will cover KrF, I-line, immersion and beyond

Kingsemi photolithography track

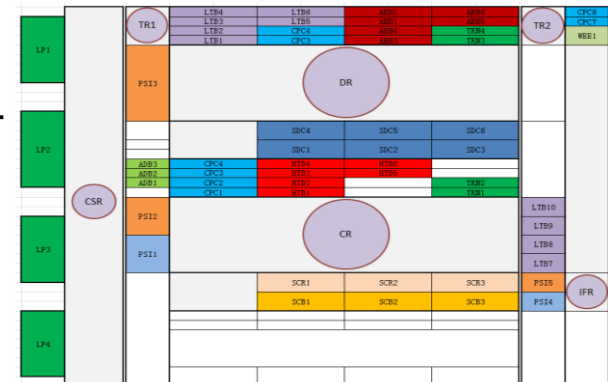
- Latest development status

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Kingsemi FEOL photo track has been developed for volume production for logic and memory customers.

- Designed from ground up, based on learnings from 02 special R&D program, focusing in improvements for yield and productivity
- Supports mainstream photolithography technologies, including BARC, ArF, KrF and I-line
- Flexibility to operate in-line or off-line
- Alpha-phase equipment has finished marathon test; Beta-phase equipment to be deployed to multiple major fabs in China
- Throughput up to 240 WPH



Kingsemi photolithography track

- Hardware features and innovations

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			Productivity	Defects	Performance	CoO
Category	Item	Design feature				
Coater	Chemical delivery	Chemical automatic recirculation		√		√
		Real-time dispense monitoring		√	√	
		Multi-nozzle arm to reduce overhead time	√		√	
		Automatic nozzle clean and segmented suckback function		√	√	√
		CFD-optimized cup design and new material		√	√	
Baker	Temperature control	Integrated cooling and heating plate with high speed drive	√		√	
	New heater design	Multi-zone distributed heating for temperature uniformity	√		√	
Platform	HMDS chamber	CFD-optimized aerodynamic design		√	√	
	Transfer robot	High-speed precision robot that enables 300Wph throughput	√	√		√
	Wafer holding mechanism	Adaptive vacuum pads to avoid bevel contact		√	√	

Kingsemi photolithography track

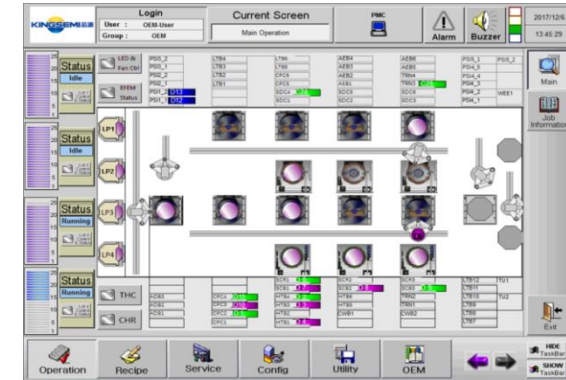
- Software features & GUI

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Operator-friendly GUI, intuitive and easy to use

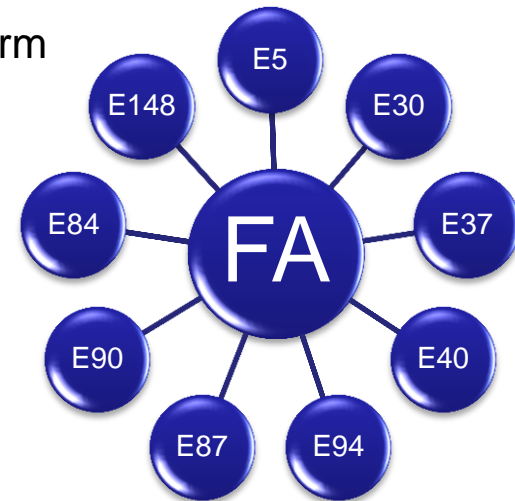
- Main window with all unit overview
- Easy to use recipe editor
- One-click routines, such as dummy run and cup clean
- Full-functionality manual mode



Full-equipment data logging capabilities

- All operations from GUI recorded; Alarm database stores all alarm events for over 6 months
- Job database records all lot related information
- Support FDC and customized SVID integration
- Smart self-diagnostics functionalities

Security – user access level specific GUI



Kingsemi photolithography track

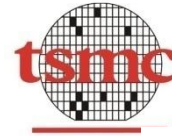
- Field performance data

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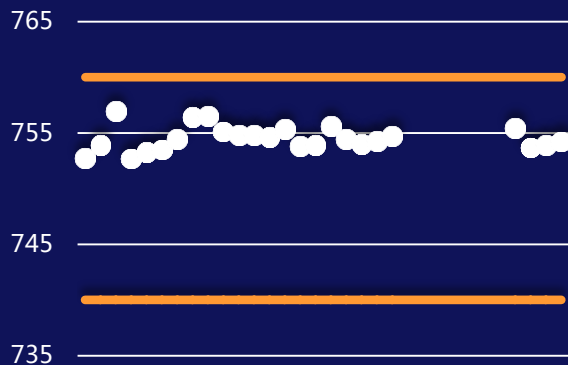
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Application 1 – BARC film (customer A)

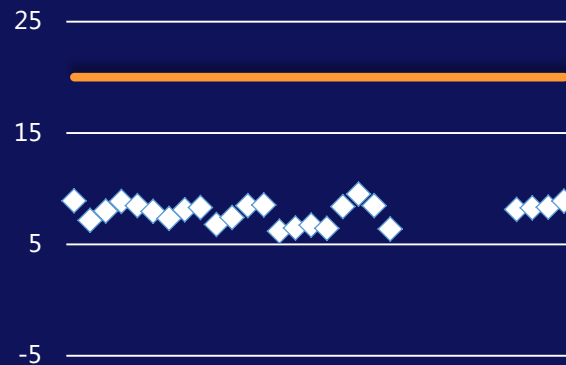
- Thickness spec: 750Å, OOC: $\pm 12\text{Å}$; OOS: $\pm 18\text{Å}$
- Uniformity spec: OOC: 20Å; OOS: 25Å
- Met spec for 60 days continuous production



Thickness Mean



Thickness Range



Dry particle Size $\geq 90\text{nm}$



Thanks

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