

Advanced Wet-Cleaning Tools for Leading Edge IC Fabs

January 14, 2020



Disclaimer

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Market Data. Information presented below under "Who is ACM Research?", "ACM is Growing at a Rapid Pace," "Well-Positioned to Participate in Asia Fab Investments" and "Investment Highlights" contains estimates, including forecasts, of Gartner, Inc. ("Gartner") and Semiconductor Equipment and Materials International ("SEMI"), including concerning ACM Research's total addressable market ("TAM") and other addressable markets. The Gartner report in which the information attributed to Gartner appears represents research opinions or viewpoints that are published in a report, as part of a syndicated subscription service, by Gartner and that are not representations of fact. The information attributed to SEMI represents research opinions or viewpoints that were published, as part of a press release, by SEMI and are not representations of fact. Each of the Gartner report and the SEMI release speaks as of its original publication date (and not as of the date of this presentation), and the opinions expressed therein the Gartner report are subject to change without notice. This information involves a number of assumptions and limitations, and you are cautioned not to rely on or give undue weight to this information. ACM Research has not independently verified the accuracy or completeness of this information. The industry in which ACM Research operates is subject to a high degree of uncertainty and risk due to variety of factors, including those described in ACM Research's public filings with the Securities and Exchange Commission, as described above.

Note Regarding Presentation of Non-GAAP Financial Measures. Information presented below under "ACM is Growing at a Rapid Pace," "Q3 2019 Operating Highlights" and "Q3 2019 Financial Results" includes certain "non-GAAP financial measures" as defined in Regulation G under the Securities Exchange Act of 1934, including Adjusted EBITDA, Adjusted Net Income, non-GAAP gross margin, non-GAAP operating margin and Non-GAAP Gross Profit. A reconciliation of each non-GAAP financial measure to the most directly comparable GAAP financial measure is included under "GAAP to Non-GAAP Reconciliation."



Who is ACM Research?

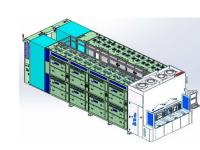
Mission Statement: To Become a Leading Global Provider of Semiconductor Capital Equipment

- Best-in-class semiconductor wafer cleaning tools providing higher yields and better efficiency at advanced fabs than conventional wafer cleaning tools
- Differentiated megasonic technology delivers highly effective singlewafer wet cleaning for flat and patterned wafer surfaces (SAPS) and damage-free cleaning for 2D and advanced 3D patterned wafers (TEBO)
- ~\$3B single-wafer wet cleaning TAM⁽¹⁾, an estimated 50% of which is addressed by current products with future expansion from new products
- More than 220 patents issued in the U.S., China, Japan, Korea, Singapore and Taiwan as of 9/30/19
- 86,000 sq. ft. across two production facilities in Shanghai offers significant capacity for growth
- Headquartered in Fremont, CA with more than 270 employees globally

Clean
SAPS TEBO Ultra – C Tahoe





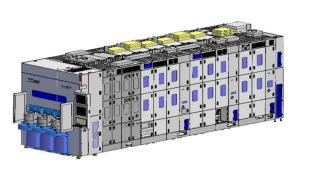


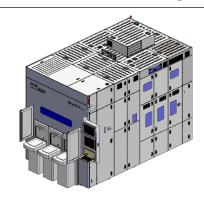
Advanced Packaging

Ultra Electrochemical Plating AP

Plating

Ultra Electrochemical Plating MAP

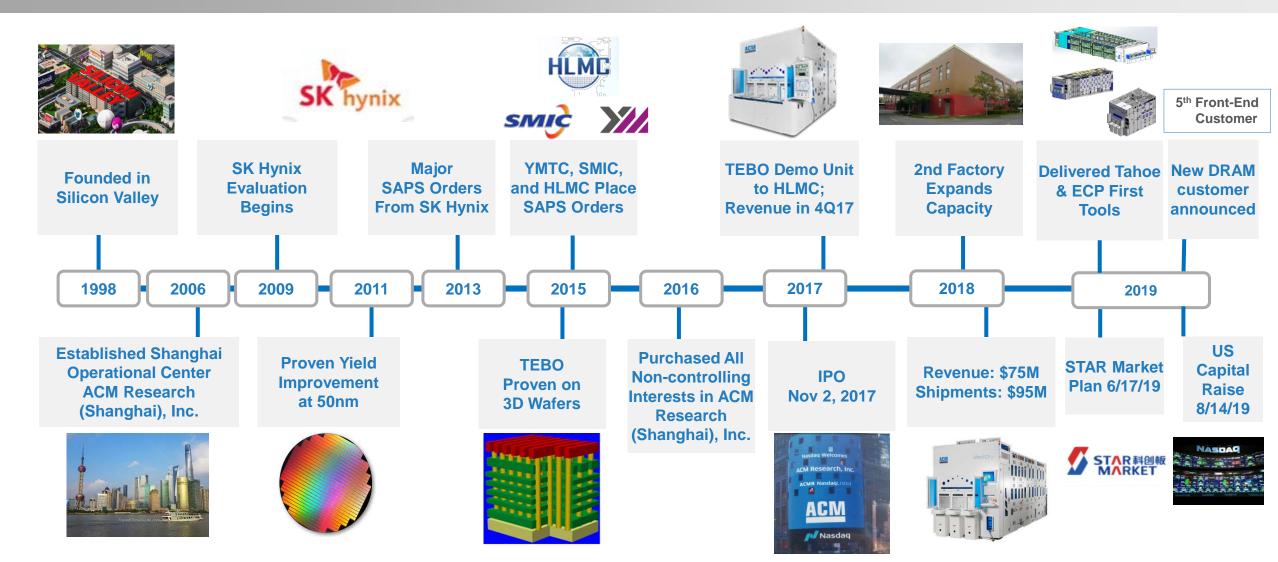




(1) Source: Gartner – 2018 Auto Wet Stations, Single-Wafer Processors and Other Clean Process markets.



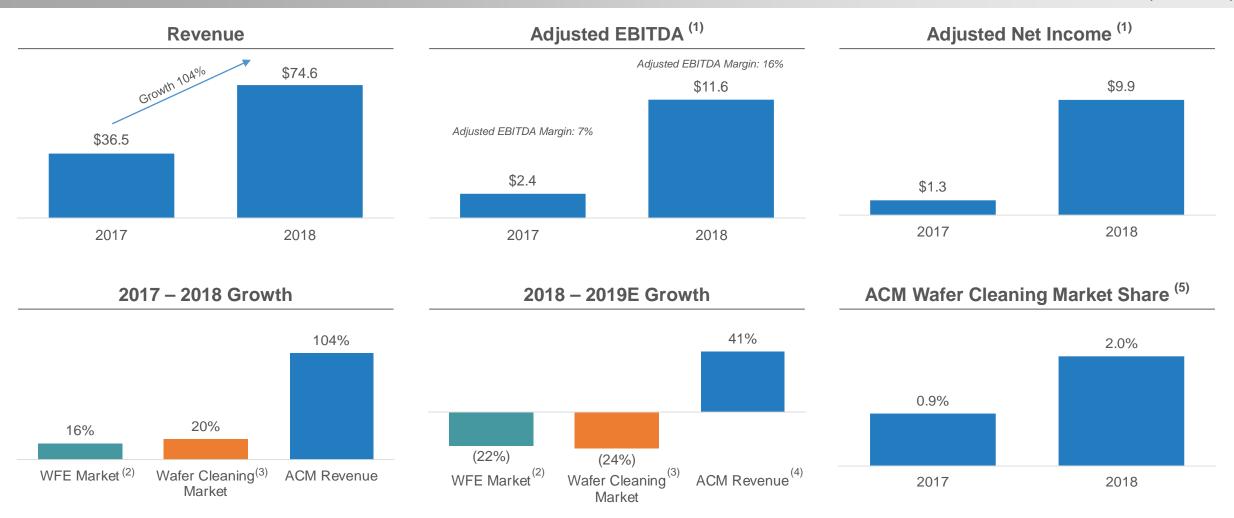
History of Innovation & Customer Adoption





ACM is Growing at a Rapid Pace

(\$ in millions)



⁽¹⁾ Based on non-GAAP financial statistics. (2) Source: Gartner – Global Wafer Fab Equipment Market (Including Wafer-Level Packaging). (3) Source: Gartner – Auto Wet Stations, Single-Wafer Processors and Other Clean Process markets. (4) On 1/13/20, ACM Research reported preliminary 2019 revenue of \$105 million to \$107 million. (5) Calculated as ACM Research wafer cleaning revenue / Wafer Cleaning Market size in each respective year.



What is Wafer Wet Cleaning?

Wafer cleaning is a critical process in wafer fabrication that is repeated more than any other process

- Random defects arise during virtually all process steps in the wafer manufacturing process, resulting in yield loss and impaired chip performance
- Cleaning is the process of eliminating random defects on wafers
- There are two basic types of cleaning: wet cleaning and dry cleaning
- Cleaning typically occurs between other process steps (e.g., etch, deposition)

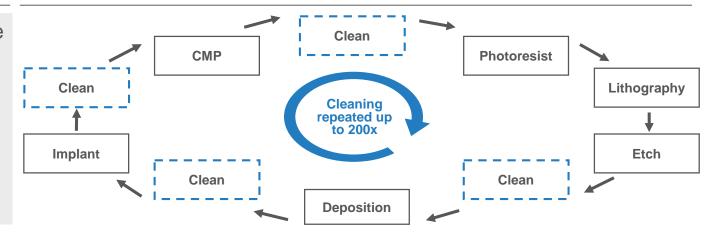
Key Benefits

- ✓ Improved Yield
- ✓ Customer Satisfaction
- ✓ Reduces Costs
- ✓ Extends Moore's Law

Wet Cleaning

- Uses liquid chemistry to spray, scrub, etch and dissolve random defects
 - ▶ Liquid chemistries include combinations of solvents, acids and water
- More effective than dry cleaning in achieving surface cleanliness and smoothness
 - ~90% of cleaning steps in wafer fabrication

Front-End Processing Steps





Semiconductor Roadmap Requires More Advanced Cleaning Capabilities

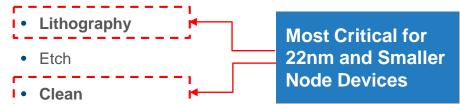
ACM products drive yield benefits across logic, NAND and DRAM

IC Roadmap: Transistor Shrink, FinFETs & Larger Wafers (1)



Key Process Equipment Groups

- Implantation
- Deposition

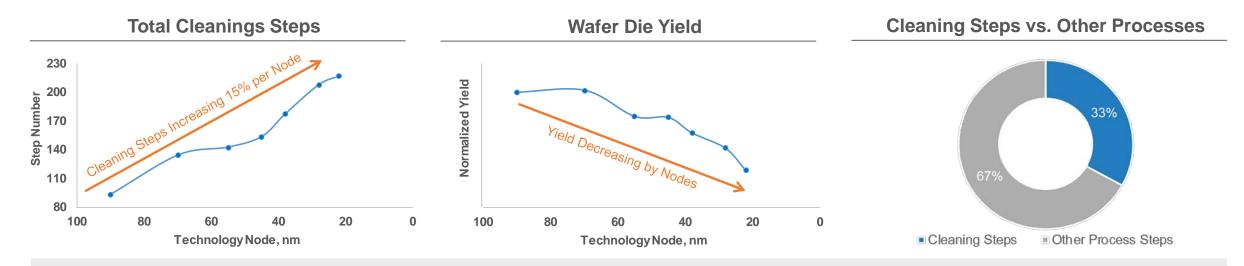


- CMP
- Metrology





Wafer Cleaning is More Important Now Than Ever



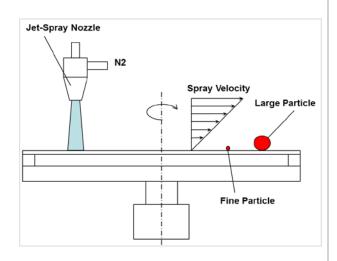
- Eliminating random defects through precise wafer cleaning steps is a critical component of the semiconductor manufacturing process
- Over the past 25 years wafer wet cleaning has become increasingly sophisticated and efficient in order to keep up with the rapid downsizing of device features
- Cleaning steps account for one third of all process steps and can be repeated up to 200 times
- 1% yield loss can lead to annual profit decrease of \$30M to \$50M (1)





SAPS Clean Technology: Uniformly Removes Fine Particles/Defects

Single Wafer Jet-Spray Clean

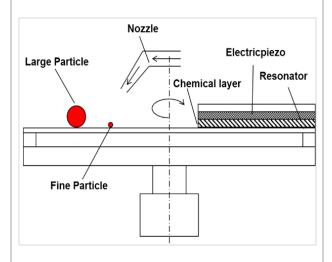


- Legacy solution used in semi-critical steps
- Ineffective in removing small particles at more advanced nodes

Megasonic Removes Small Particles

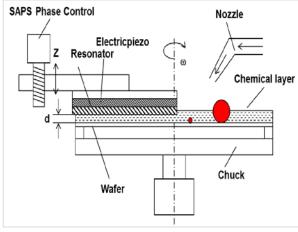
- Megasonic wave creates cavitation
- Cavitation moves particles away from surface

Conventional Megasonic Clean



- Effectively removes defects below 45nm
- Challenges with warped wafers
- Damage to patterned structures

ACM Megasonic: SAPS

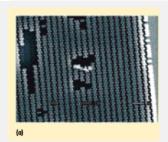


- Proprietary SAPS ultrasonic design
- Uniform energy delivery
- Proven results for DRAM, 3D NAND, and Foundry processes



TEBO: Proprietary Technology Reduces or Eliminates Feature Damage

As device features become *smaller and more fragile* with high aspect ratios (feature structure depth to width ratio), conventional cleaning processes can lead to damages and loss of yield



SEM images of damages at 50-nm DRAM storage capacitors following a dSC-1 clean with megasonics in a batch immersion tool using high power densities

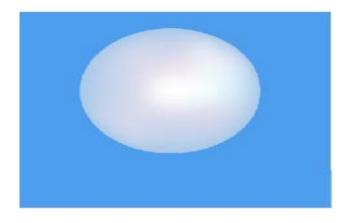
Source: Micromagazine.fabtech, by John Rosato, et al., *SCP Global Technology*

Conventional Megasonic Cleaning



Transit cavitation results in violent micro-jet causing damage to wafer structures

TEBO Megasonic Cleaning



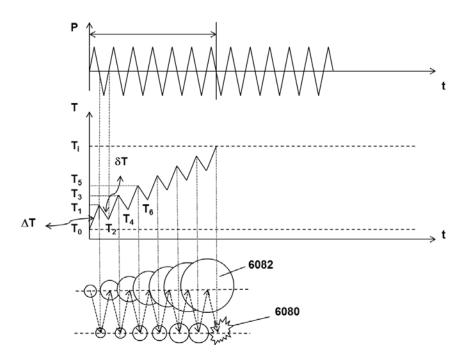
Stable cavitation



TEBO Technology: Works by Controlling Transit Cavitation Formation

Conventional Megasonic Cleaning

Transit Cavitation Implosion Damages Wafer Structure



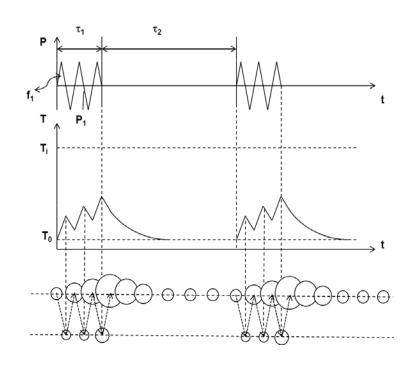
TEBO Megasonic Cleaning

Stable Cavitation, Effective Cleaning, Low/No Damage

Megasonic Energy Cycles

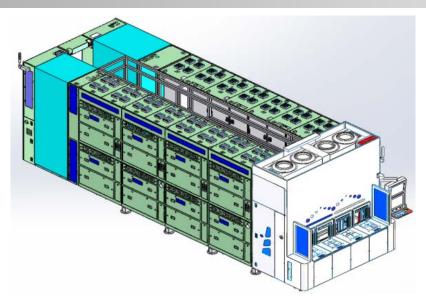
Cavitation Temperature

Cavitation
Size in
Oscillation





Core Technology: Ultra C Tahoe (Bench +Single, Covered 20% Clean Process)



- > Technology Advantage: Combine the process and cost of the single & bench cleaning process:
 - > Cost saving of SPM, reduced the cost of sulfuric acid >80%, in 100K/month mass production line, the annual saving of sulfuric acid >12M USD.
 - > **Environmental friendly.**
 - > Integrated wet bench & single clean process, reduced process step, enhanced performance, shorten the production cycle time.
- > Key applications:
 - > High temperature SPM PR stripper process : ETCH/IMP Post CLN.
 - Post CMP Cleaning.
 - > High temperature H3PO4 Wet Etch & Clean Process.
 - > Metal Film Removal: Metal Strip.

(Multiple Global IP Protected)



Single-Wafer Wet Cleaning Products

Innovative, patent-protected tools address critical challenges in leading edge IC manufacturing

SAPS



Megasonic Cleaning for Flat and Patterned Wafer Surfaces

- √ High efficiency with enhanced process flexibility
- ✓ Uniform and consistent results
- ✓ Customizable specifications

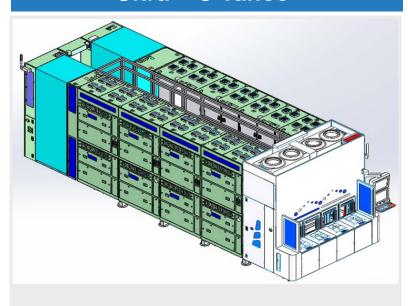
TEBO



Bubble Oscillation Cleaning for Patterned Wafers at Advanced Process Nodes

- ✓ Highly effective, damage-free solution for small and fragile features
- ✓ Multi-parameter bubble cavitation control

Ultra – C Tahoe



Hybrid Wafer Cleaning With Significant Cost & Environmental Benefits

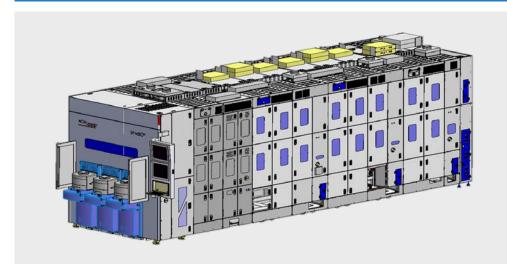
- ✓ Environmentally friendly uses 1/10 of the sulfuric acid used than conventional tools
- High cleaning performance at low cost



New Electrochemical Plating Products Significantly Increase TAM

Delivers significant benefits to customers, including greater performance, increased flexibility and improved cycle times

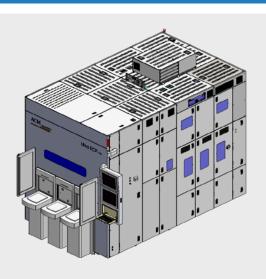
Ultra ECP AP



Advanced Wafer Level Packaging (Back-end Assembly Tool)

- ✓ Back-end assembly tool used for applying copper, tin and nickel to wafers at the die level before packaging
- Produces uniform and consistent results

Ultra ECP MAP



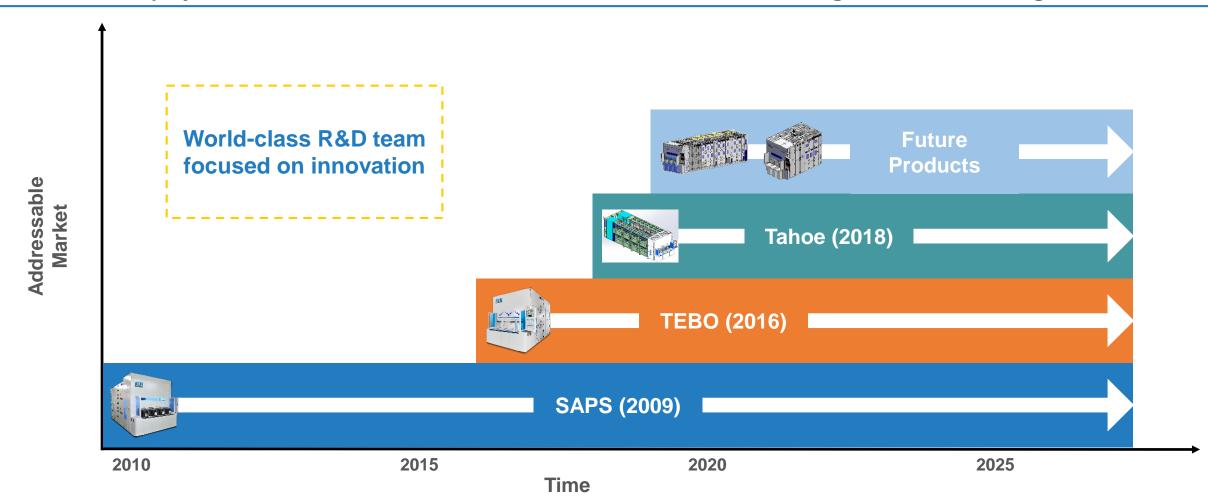
Multi Anode Partial Plating (Front-End Wafer Fabrication Processes)

- ✓ Delivers world-class electrochemical copper plating for advanced copper interconnect applications
- ✓ Offers significant performance advantages relative to competitors



Innovation and Product Introductions Expanding Addressable Market

ACM projects that SAPS, TEBO, and Tahoe address more than 50% of the single-wafer wet cleaning market





Tier One Customer Base

Front-End Customers



- Major new entrant into NAND flash and DRAM industry
- Expanding capacity with construction of \$24B production facility in Wuhan⁽¹⁾
- Proprietary Xtacking architecture used to produce 3D NAND products⁽²⁾
- ACM 2018 Revenue %: 39% (primarily 3D NAND)



- Leading advanced foundry in China
- Manages first fully automated 300mm wafer production line in mainland China⁽³⁾
- Production capacity for 35,000 wafers per month⁽⁴⁾
- ACM 2018 Revenue %: 24% (primarily Foundry / Logic)



- Global market leader in memory (DRAM & NAND) semiconductor products
- · ACM's first major customer
- Expected to spend \$107B in the coming years to build four new memory chip plants⁽⁵⁾
- ACM 2018 Revenue %: 23% (primarily DRAM)

Back-End Customers

jcap

- Largest bumping house in China and leading WLCSP production base
- Subsidiary of OSAT company JCET
- Owns one of the most advanced packaging technology R&D service platforms⁽⁷⁾
- Global customer base with exposure to the U.S., Western Europe and Asia



- Mainland China's largest foundry
- Tier one customer base including Qualcomm, Broadcom and Texas Instruments
- Six strategically located fabs in China and Western Europe
- Building \$10B fab to produce 14nm, 10nm and 7nm chips⁽⁶⁾

New DRAM Customer

- New China-based entrant to DRAM industry
- Ordered 12-Chamber SAPS-V tool for evaluation
- ACM expects to deliver first-tool in Q4 2019, with revenue recognition upon acceptance

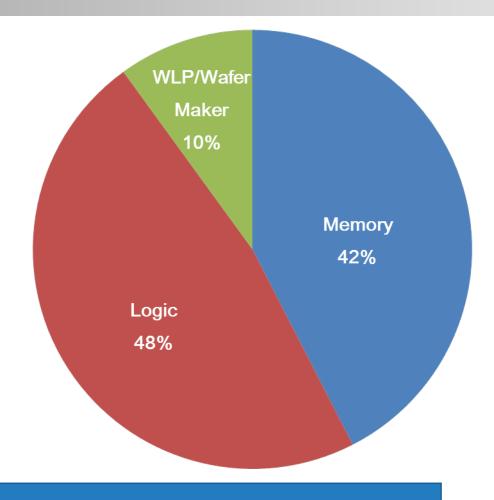


- Leading OSAT provider #7 globally⁽⁸⁾ and top 3 in China⁽⁹⁾
- Fastest growing OSAT provider globally with 32% year-over-year revenue growth⁽⁸⁾
- Six production facilities serving more than half of the top ten global semiconductor manufacturers⁽⁹⁾

(1) Source: Nikkei Asian Review. (2) Source: YMTC Press Release. (3) Source: HLMC Press Release. (4) Source: Reuters. (6) Source: AnandTech. (7) Source: JCAP Company Profile. (8) Source: Electronics Weekly. (9) Source: TFME website.



ACM 2019 Revenue by Customer Application



2019 Revenue Projection: \$105 M to \$107M*

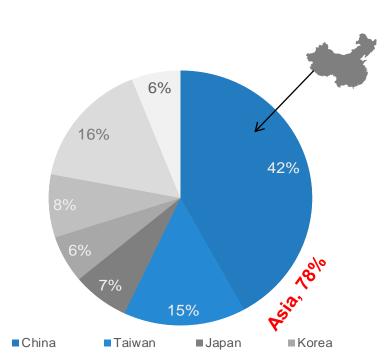


Well-Positioned to Participate in Asia Fab Investments

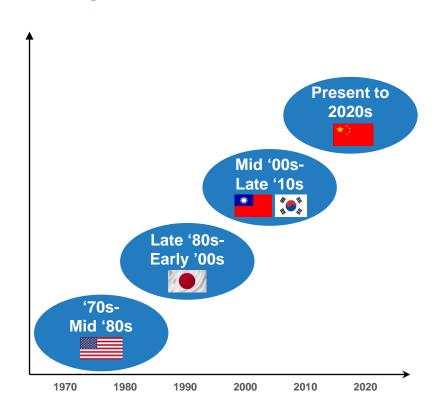
Semiconductor Industry Development

(\$ in billions)

New Facilities and Production Lines Starting Operation (2017-2020)⁽¹⁾



Industry Center Shifts
Through the Decades(1)



China is the Fastest Growing Geography⁽²⁾

Rank	Country or Region	2020 Size	16-'20 CAGR
1	*	\$14.1	4%
2	*:	\$13.1	19%
3		\$11.9	11%
4	North America	\$7.7	15%
5		\$6.6	9%
	Rest of World	\$6.5	3%



■ SE Asia

Americas

Strong presence in Asia and close proximity to Chinese customers add to key competitive advantages.

(1) Source: SEMI – World Fab Forecast Report. (2) Source: SEMI – 12/11/2019 Global Semiconductor Equipment Sales Forecast.

Europe & ME



Shanghai Manufacturing Facilities

Factory #1 (Shanghai HQ)



- Original ACM factory
- 36,000 sq. ft. facility
- 8,000 sq. ft. of class 10,000 clean room space for product assembly and testing
- 800 sq. ft. of class 1 clean room space for product demonstration purposes
- Co-located with ACM Shanghai Headquarters and China R&D Center

Shanghai Locations





Facility #2



- Second factory; opened in September 2018
- 50,000 sq. ft. facility
- Shifting large portion of future production to this facility
- Additional dedicated space for product subassembly, component inventory and manufacturing related offices
- 2nd floor available for additional expansion



Strategic Investment Plan – Access China's Capital Markets

- Announced in June 2019
- Plan to list shares of ACM Research (Shanghai), Inc., the principal operating subsidiary of ACM Research, on Shanghai Exchange's Sci-Tech innovAtion boaRd ("STAR Market")
 - Direct access to local capital to support China operations
 - ▶ Relatively attractive valuation vis-à-vis current NASDAQ trading prices for ACM Research common shares
 - ▶ Raise profile within the business and investment communities
- \$27.3 million* private placement first step to qualify for STAR Market listing
 - ▶ \$23.5 million* was invested from third-party investors at **\$675 million*** pre-money valuation
 - ▶ \$3.8 million was invested from ACM employees at a discount
- Completed restructure of ACM Research (Shanghai), Inc. to qualify for STAR Market listing in November 2019
- Completed a second tranche of private equity investments of \$32.4 million[†] in December 2019, total two tranche of private equity investment: \$59.7 million with total dilution of 8.3%.
 - Potential for STAR Market premium to enable significant capital raise at just additional 10% dilution
- ACM Research remains committed to NASDAQ listing status and global market opportunities

[†] Based on China RMB to US dollar exchange rate on 11/29/2019, the effective date of the agreement.



^{*} Based on China RMB to US dollar exchange rate on 6/12/2019, the effective date of the agreement.

Q3 2019 Operating Highlights

Solid Q3 Results

- ▶ \$33.4 million revenue, up 44% from Q3 2018
- ► 48.6% GAAP gross margin and 21.0% GAAP operating margin
- ▶ 49.1% non-GAAP gross margin and 25.7% non-GAAP operating margin

Total shipments of \$43 million in Q3 2019

Increase of 34% from Q3 2018

Key operational progress:

- Delivered SAPS-V "first tool" to a new DRAM customer in China
- ► Technical trials of Ultra-C Tahoe demo tool are progressing well
- ► Delivered several Ultra ECP AP "first-tools" to a major key packaging customer

\$47 million cash and equivalents

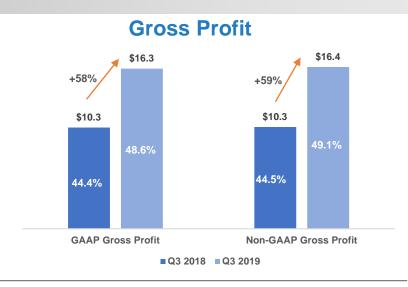
- Balance sheet better matches ACM to customer base and opportunity
- Successful U.S. capital raise in Q3 2019
- Does not include segregated and restricted cash raised from China PE investors in connection with proposed STAR Market listing



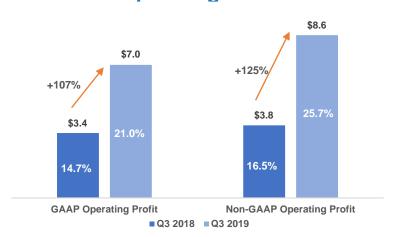
Q3 2019 Financial Results

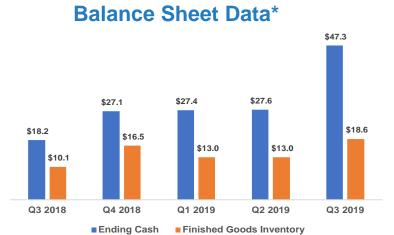
\$ Millions, non-GAAP gross profit and operating profit





Operating Profit





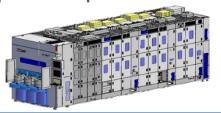
^{*} Finished goods inventory represents 'demo-to-sales' product which have been delivered to customers for evaluation. These products are carried at cost until ownership is transferred.



Growth Strategy

New Product Introductions Increasing TAM

- Next generation TEBO and Tahoe products expand SAM in wafer clean
- Front- and back-end plating tools offer growth opportunities in adjacent process steps



Continue to Build Scale in Asia

 Gain meaningful share by offering differentiated, leading edge technology and localized service with fast-growing Asian-based customers



Add New Customers

 Megasonic approaches SAPS, TEBO, Tahoe and ECP a driving meaningful engagement with Global Tier 1 foundry, logic and memory companies



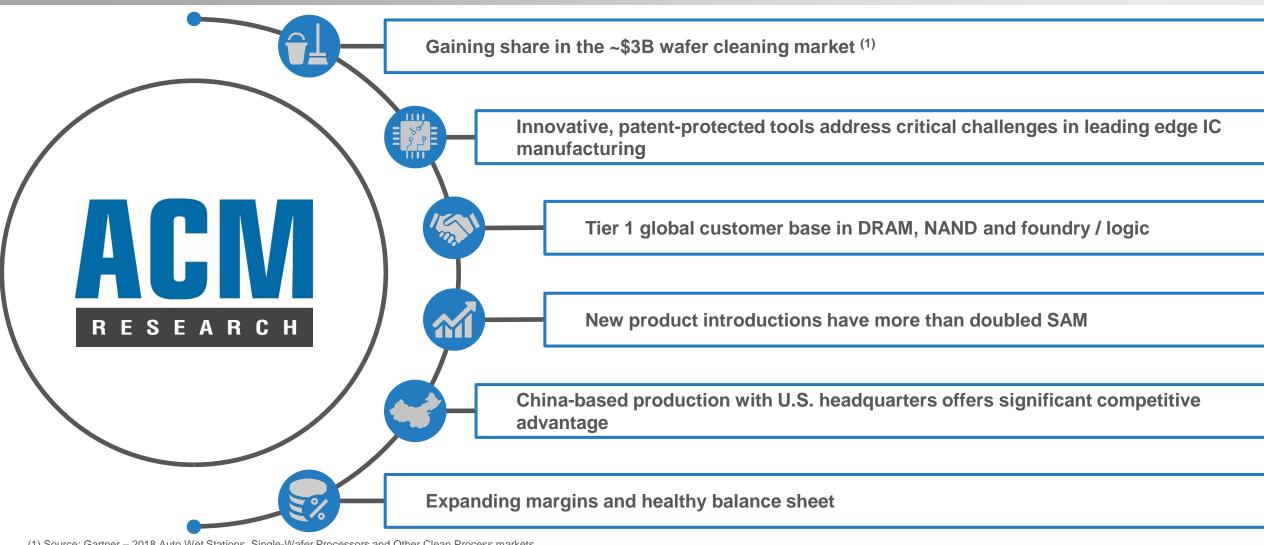
Selective Acquisitions

 Use M&A to broaden product portfolio, add complementary technologies and increase access to the global market





Investment Highlights



(1) Source: Gartner - 2018 Auto Wet Stations, Single-Wafer Processors and Other Clean Process markets.



	<u>2016</u>	<u>2017</u>	<u>2018</u>	9 Months Ended 9/30/2019
GAAP Income (Loss) from Operatons	\$3.5	\$0.7	\$6.5	\$13.9
Plus: Stock-Based Compensation	\$0.4	\$1.6	\$3.4	\$2.9
Adjusted Income (Loss) from Operations	\$3.9	\$2.3	\$9.8	\$16.9
GAAP Net Income (Loss)	\$2.4	\$ (0.3)	\$6.6	\$15.0
Plus: Interest Expense, Net	\$0.2	\$ 0.3	\$0.5	\$0.5
Plus: Income Tax Expense	\$0.6	\$ 0.5	\$0.8	\$0.7
Plus: Depreciation and Amortization	\$0.2	\$ 0.3	\$0.4	\$0.7
Plus: Stock-Based Compensation	\$0.4	\$ 1.6	\$3.4	\$2.9
Adjusted EBITDA	\$3.7	\$ 2.4	\$11.6	\$19.8
GAAP Net Income (Loss)	\$1.0	\$ (0.3)	\$6.6	\$15.0
Plus: Stock-Based Compensation	\$0.4	\$ 1.6	\$3.4	\$2.9
Adjusted Net Income (Loss)	\$1.4	\$1.3	\$9.9	\$17.9



GAAP to Non-GAAP Reconciliation (2)

	Three Months Ended September 30,										
	2019							2018			
	Actual (GAAP)			Adjusted (Non-GAAP)			Actual (GAAP)		Ad	Adjusted (Non-GAAP)	
									(Non		
			(In thousa			sar	nds)				
Revenue	\$	33,427	\$	-	\$	33,427	\$	23,179	\$	- \$	23,179
Cost of revenue		(17,173)		(154)		(17,019)		(12,892)		(25)	(12,867)
Gross profit		16,254		(154)		16,408		10,287		(25)	10,312
Operating expenses:											
Sales and marketing		(3,886)		(172)		(3,714)		(3,229)		(42)	(3,187)
Research and development		(3,492)		(759)		(2,733)		(2,264)		(64)	(2,200)
General and administrative		(1,846)		(472)		(1,374)		(1,390)		(280)	(1,110)
Income from operations	\$	7,030	\$	(1,557)	\$	8,587	\$	3,404	\$	(411) \$	3,815
Net income attributable to ACM Research, Inc.		8,782	\$	(1,557)	\$	10,339	\$	3,853	\$	(411) \$	4,264

	Nine Months Ended September 30,						
			2019	2018			
	Actual (GAAP)		Adjusted (Non-GAAP)		Actual	Adjusted (Non-GAAP)	
					(GAAP)		
		(In thous			ands)		
Revenue	\$	82,916 \$	- \$	82,916 \$	53,795	\$	53,795
Cost of revenue	Ψ	(44,705)	(213)	(44,492)	(29,662)	(44)	(29,618)
Gross profit		38,211	(213)	38,424	24,133	(44)	24,177
Operating expenses:							
Sales and marketing		(8,679)	(252)	(8,427)	(7,766)	(115)	(7,651)
Research and development		(9,598)	(939)	(8,659)	(6,224)	(131)	(6,093)
General and administrative		(5,992)	(1,515)	(4,477)	(6,312)	(2,481)	(3,831)
Income from operations	\$	13,942 \$	(2,919) \$	16,861 \$	3,831 \$	(2,771) \$	6,602
Net income attributable to ACM Research, Inc.	\$	14,950 \$	(2,919) \$	17,869 \$	4,288 \$	(2,771) \$	7,059



Tahoe SPM Cost Comparison Vs. Single SPM (900ml)

Items		Single	Tahoe (Bench+Single)	Remark
Capacity / day (both based on same outp	ut 2K wafer)	2000	2000	*Single SPM recipe:SPM90S+SC30S+SCN30S, WPH 80pcs, Uptime 95% *Tahoe recipe:SPM300S+QDR300S+SC60S+SCN60S,W PH 90pcs, Uptime 95%
Bath Volmue (L)		/	40	
Dosing Volmue (L)		/	160	
Loading Size		1sls	12sls	
SPM Mix Ratio (H2SO4:H2O2)	2:1	4:1	
	H2SO4(L)	0.9	0.096	*Tahoe SPM life time: 12hrs (total 240L/day)
Usage/pc	H2O2(L)	0.45	0.024	*Single SPM flow rate: 0.9lpm (process time 1.5min)
Wasto/day	Waste/day $\frac{H2SO4(L)}{H2O2(L)}$		192	
vvasie/day			48	
Waste Saving/day	H2SO4(L)		1608	1800-192
(Calculated by Wast per day)	H2O2	2(L)	852	900-48
Waste Saving/day	H2SO4(L)		89.33%	1608/1800
(Calculated by Wast per day)	H2O2(L)		94.67%	852/900
Total H2SO4 saving Vol L /year			586920	1608L x 365 day
Total H2SO4 saving \$ /year			\$ 586,920.00	H2SO4 = \$1/L

• Tahoe cuts sulfuric acid use by 80% for obvious environmental and regulatory benefits and >\$0.5M sulfuric acid savings per machine-year

