ACM RESEARCH

Advanced Wet-Cleaning Tools for Leading Edge IC Fabs

May 2020

Market Data. Information presented below under “Who is ACM Research,” “ACM is Growing at a Rapid Pace,” “Investment Highlights” concerning ACM Research’s total addressable market presents a forecast based on information provided by Gartner, Inc. in its report “Forecast: Semiconductor Wafer Fab Manufacturing Equipment (Including Wafer-Level Packaging), Worldwide, 4Q19 Update” (December 2019). You are cautioned not to rely on or give undue weight to this information. The Gartner report represents research opinions or viewpoints that are published, as part of a syndicated subscription service, by Gartner and are not representations of fact. The Gartner report speaks as of its original publication date (and not as of the date of this presentation), and the opinions expressed in the Gartner report are subject to change without notice. While ACM Research is not aware of any misstatements regarding the information provided in the Gartner report, it has not independently verified the accuracy or completeness of that information, which involves numerous assumptions and is subject to risks and uncertainties, as well as change based on various factors, that could cause results to differ materially from the forecast presented. 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,” “Q1 2020 Highlights,” and “Q1 2020 Financial Results” includes certain “non-GAAP financial measures” as defined in Regulation G under the Securities Exchange Act of 1934, including non-GAAP gross margin, non-GAAP operating margin, non-GAAP gross profit and non-GAAP operating profit. These supplemental measures exclude the impact of stock-based compensation, which ACM Research does not believe is indicative of its core operating results. A reconciliation of each non-GAAP financial measure to the most directly comparable GAAP financial measure is included in ACM Research’s first quarter 2020 earnings release dated May 6, 2020, which (a) has been filed with the Securities and Exchange Commission and can be viewed at https://www.sec.gov/Archives/edgar/data/1680062/000114036120010858/ex99_01.htm and (b) has been posted at, and can be downloaded from, the “Investors” content area at ACM Research’s website, http://ir.acmrcsh.com/news-releases/news-release-details/acm-research-reports-first-quarter-2020-results.

Who is ACM Research?

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

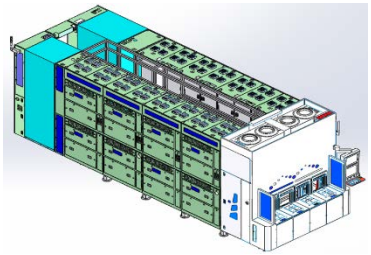
- **Best-in-class semiconductor wafer cleaning tools** providing higher yields and better efficiency at advanced fabs than conventional wafer cleaning tools
- **Differentiated megasonic technology** delivers highly effective single-wafer wet cleaning for flat and patterned wafer surfaces (SAPS) and damage-free 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 285 patents** issued in the U.S., China, Japan, Korea, Singapore and Taiwan as of 12/31/2019
- 86,000 sq. ft. across **two production facilities in Shanghai and long-term plans for Lingang Facility** offers significant capacity for growth
- **Headquartered in Fremont, CA** with more than 360 employees globally

Clean

SAPS

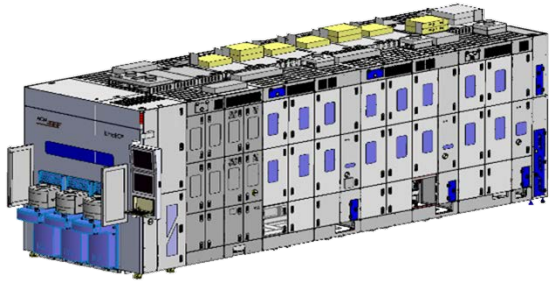
TEBO

Ultra – C Tahoe



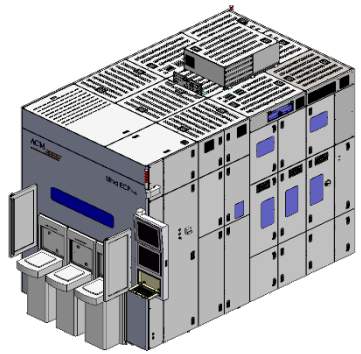
Advanced Packaging

Ultra Electrochemical Plating AP



Plating

Ultra Electrochemical Plating MAP



(1) Source: Gartner – 2019 Auto Wet Stations, Single-Wafer Processors and Other Clean Process markets.

History of Innovation & Customer Adoption

1998 — Founded in Silicon Valley

2006 — Established Shanghai Operational Center ACM Research (Shanghai), Inc.

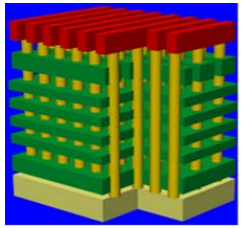
2009 — SK Hynix Evaluation Begins

2011 — Proven Yield Improvement at 50nm

2013 — Major SAPS Orders From SK Hynix

2015 — YMTC, SMIC, and HLMC Placed SAPS Orders

TEBO Proven on 3D Wafers



2017 — TEBO Demo Unit to HLMC; Revenue in 4Q17

IPO Nov 2, 2017

2018 — 2nd Factory Expands Capacity

Announced 1st P.O. for Tahoe Tool

2019 — Tahoe & ECP First Tools New DRAM Customer

STAR Market Plan 6/17/19

US Capital Raise 8/14/19

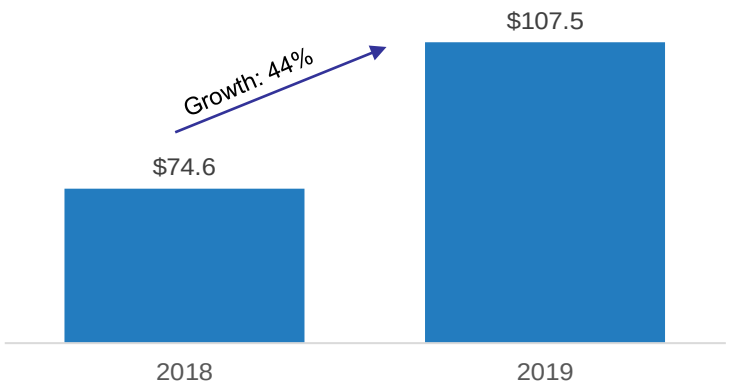
2020 — Launched SFP, Vertical Furnace and Semi-critical Cleaning Products

Lingang Agreement Signed

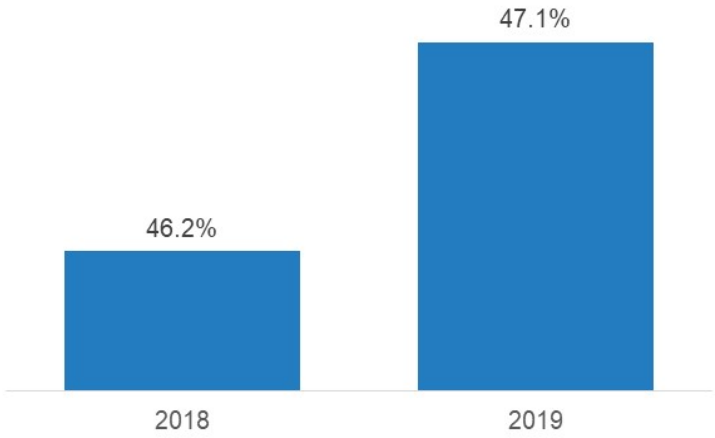
ACM is Growing at a Rapid Pace

($ in millions)

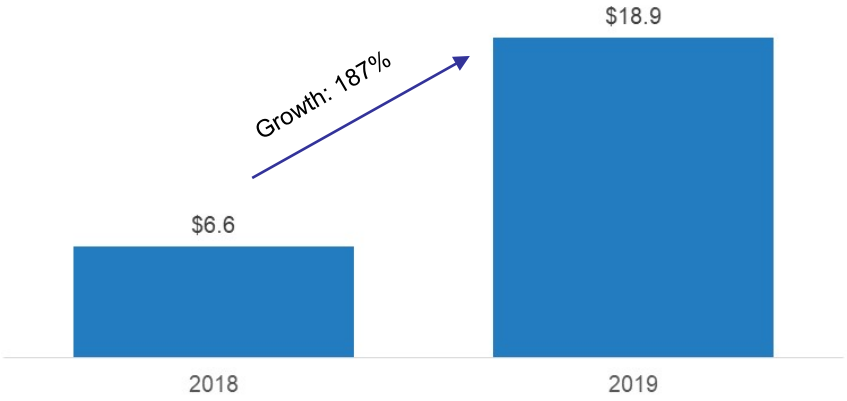
Revenue



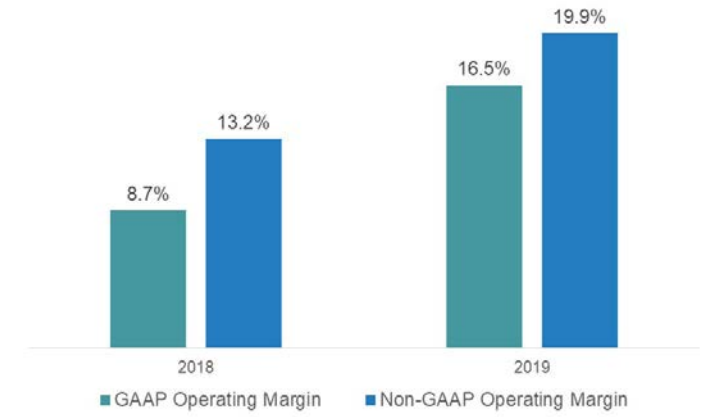
Gross Margin[1]



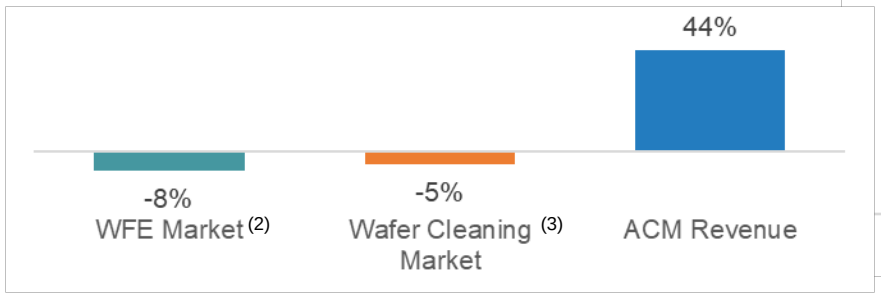
Net Income Attributable to ACM Research [1]



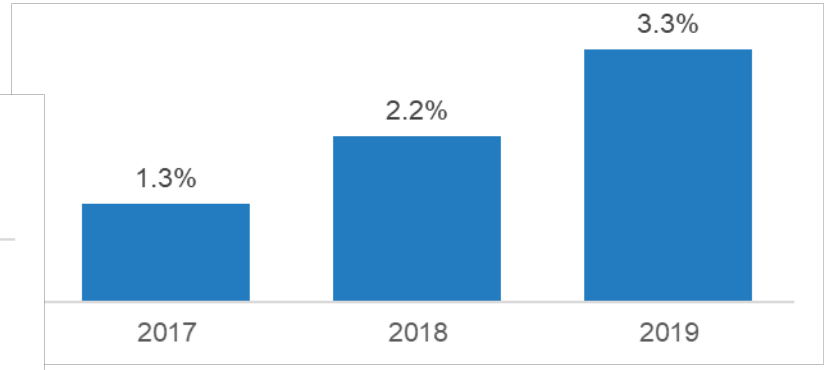
Operating Margin



2018 – 2019 Growth



ACM Wafer Cleaning Market Share [4]



(1) Based on 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) 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

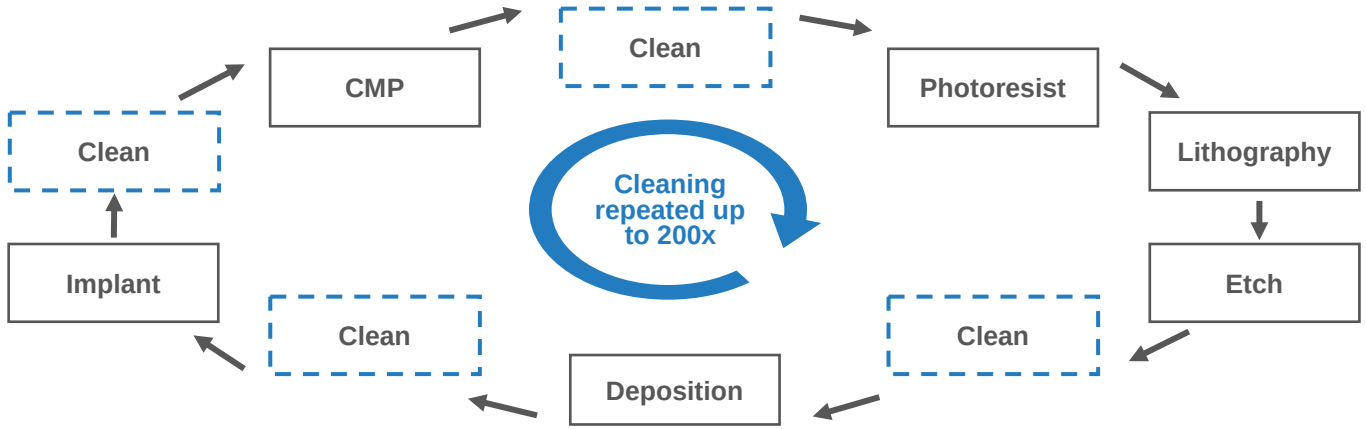
- ✓ **Improved Yield**
- ✓ **Customer Satisfaction**
- ✓ **Reduces Costs**
- ✓ **Extends Moore's Law**

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

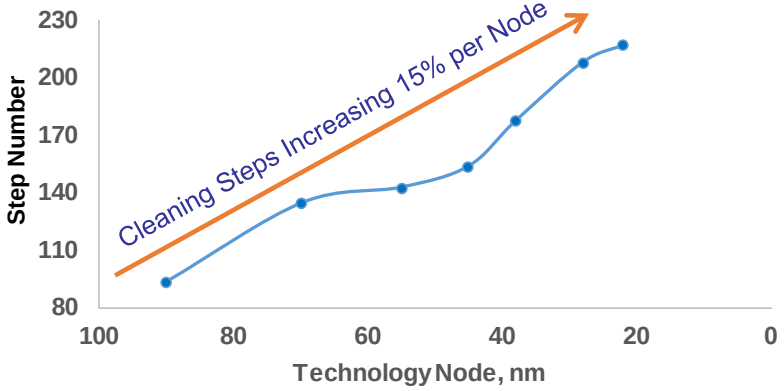
- Implantation
- Deposition
- **Lithography**
- Etch
- **Clean**
- CMP
- Metrology

Most Critical for 22nm and Smaller Node Devices

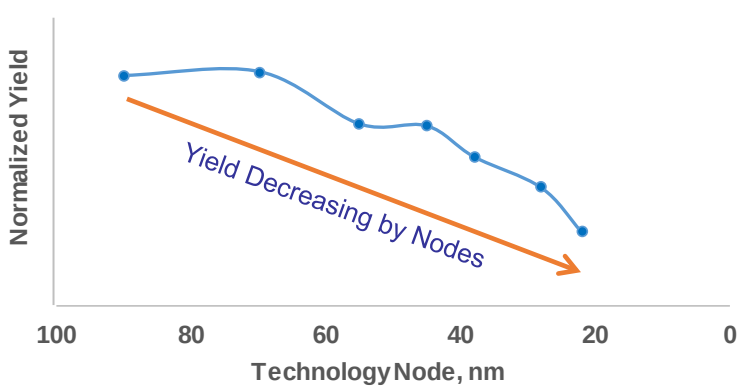
(1) Source: ASML 2019 Presentation.

Wafer Cleaning is More Important Now Than Ever

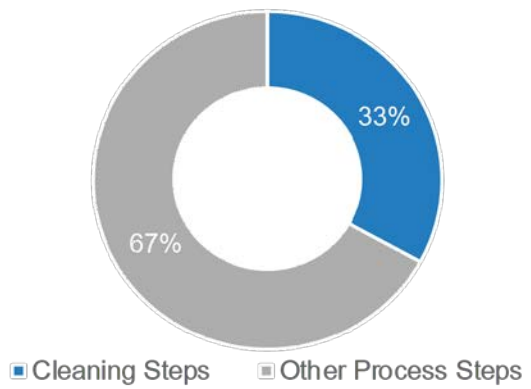
Total Cleanings Steps



Wafer Die Yield



Cleaning Steps vs. Other Processes

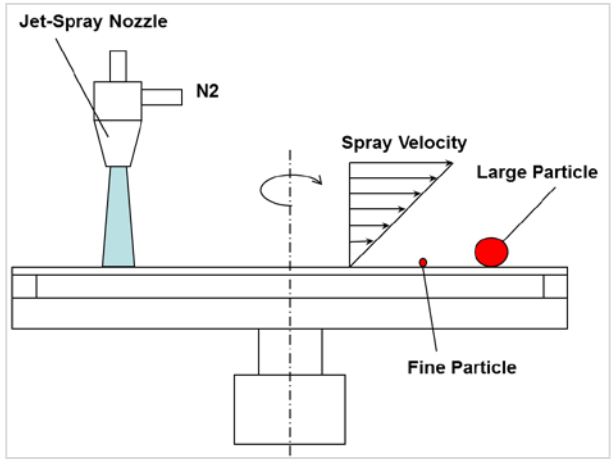


- **Eliminating random defects through precise wafer cleaning steps is a critical component of the semiconductor manufacturing process**
- **Over the past 25 years wafer wet cleaning has become increasingly sophisticated and efficient in order to keep up with the rapid downsizing of device features**
- **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)**

(1) Source: ACM customer data and ACM estimates.

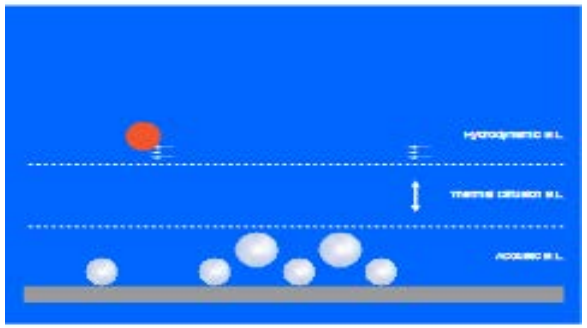
SAPS Clean Technology: Uniformly Removes Fine Particles/Defects

Single Wafer Jet-Spray Clean



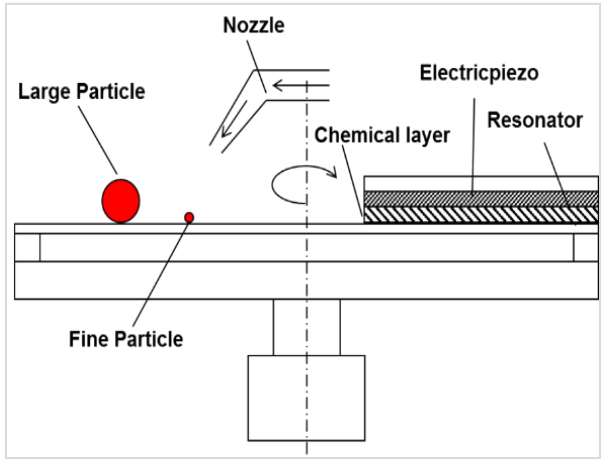
- Legacy solution used in semi-critical steps
- Ineffective in removing small particles at more advanced nodes

Megasonic Removes Small Particles



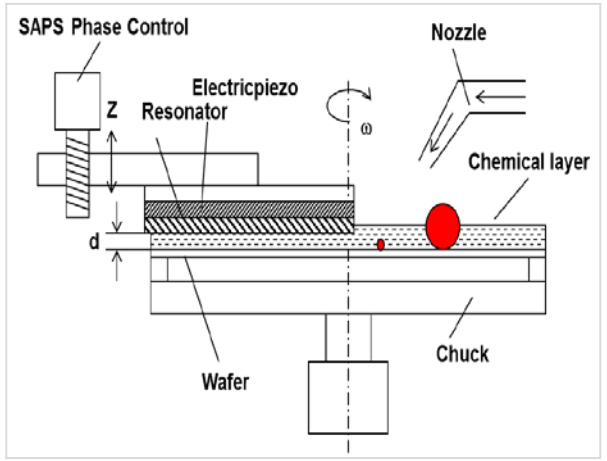
- Megasonic wave creates cavitation
- Cavitation moves particles away from surface

Conventional Megasonic Clean



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

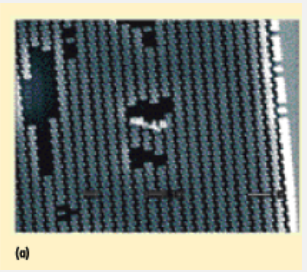
ACM Megasonic: SAPS



- 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



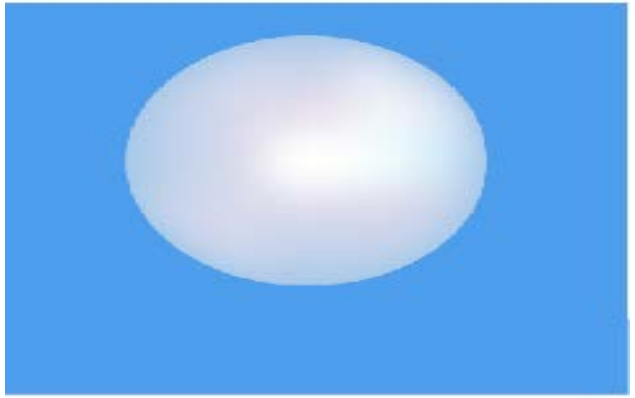
SEM images of damages at 50-nm DRAM storage capacitors following a dSC-1 clean with megasonics in a batch immersion tool using high power densities

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

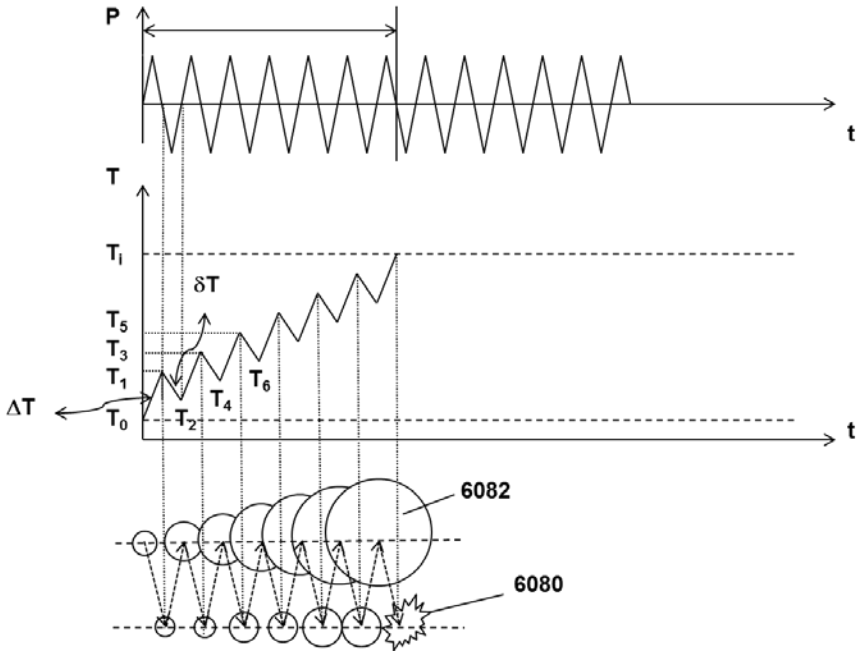


Stable cavitation

TEBO Technology: Works by Controlling Transit Cavitation Formation

Conventional Megasonic Cleaning

Transit Cavitation Implosion
Damages Wafer Structure



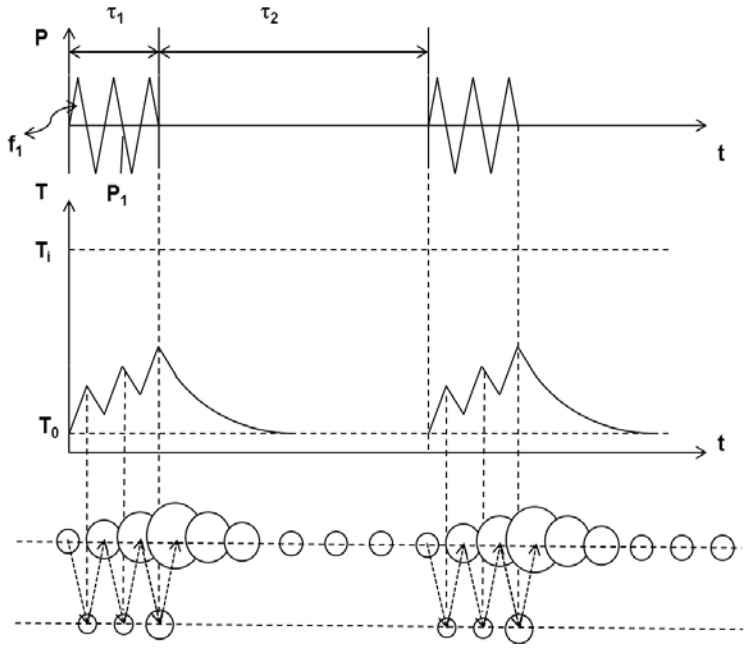
Megasonic Energy Cycles

Cavitation Temperature

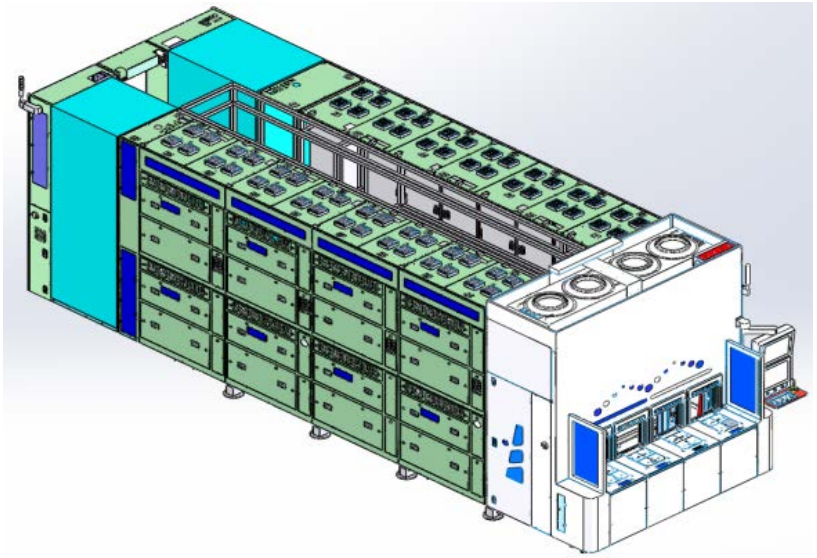
Cavitation Size in Oscillation

TEBO Megasonic Cleaning

Stable Cavitation, Effective Cleaning, Low/No Damage



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**
  - **Environmentally 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

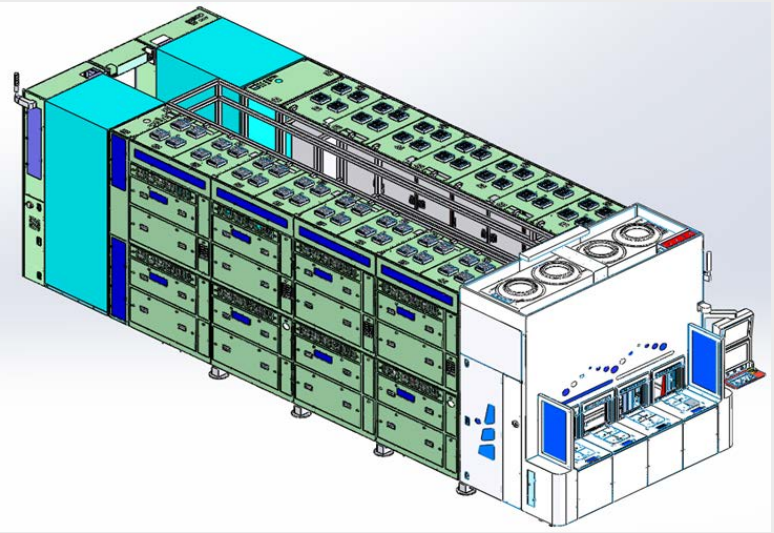
- ✓ High efficiency with enhanced process flexibility
- ✓ Uniform and consistent results
- ✓ Customizable specifications

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



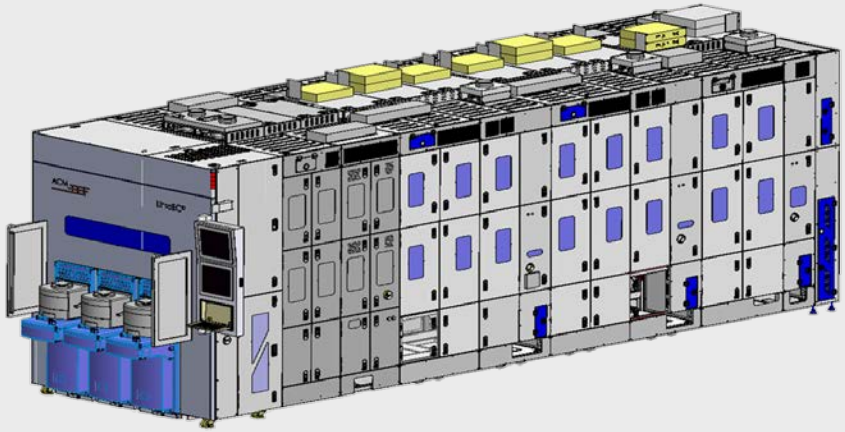
Hybrid Wafer Cleaning With Significant Cost & Environmental Benefits

- ✓ 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

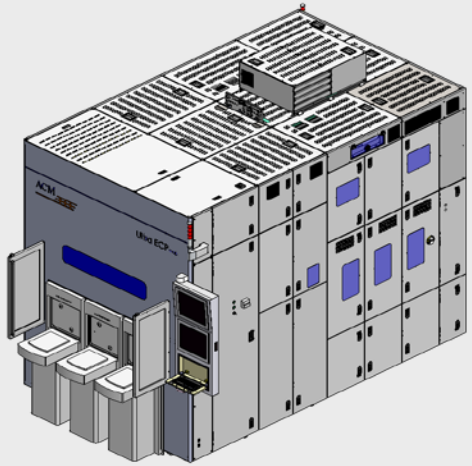
Ultra ECP ap



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



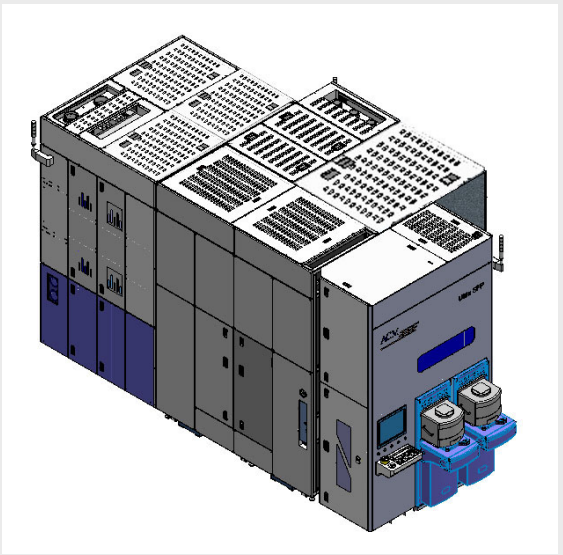
Multi Anode Partial Plating
(Front-End Wafer Fabrication Processes)

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

New SFP Product Significantly Reduces Cost of Consumables (CoC) for Customers

Delivers significant benefits to customers, including greater performance, increased flexibility and lower CoC

Ultra SFP ap



Advanced Wafer Level Packaging
(Back-end Assembly Tool)

- ✓ **Back-end assembly tool used for polishing metal film in TSV, 2.5 D in advanced package applications**

Ultra Furnace Platform Targets LPCVD, Oxidation, Annealing and ALD

The innovative system design combines newly developed hardware that improves durability, with proven software technology and a proprietary control system and algorithm.

Ultra Furnace

- ✓ **The Ultra Furnace system is intended for batch processing of up to 100 12-inch (300mm) wafers.**

Ultra C Wet Cleaning Tools for Advanced IC, Power Device, Advanced WLP Markets

Latest Suite of Ultra C Wet Cleaning Tools for Front and Backside Processes

Ultra C b

Backside Clean

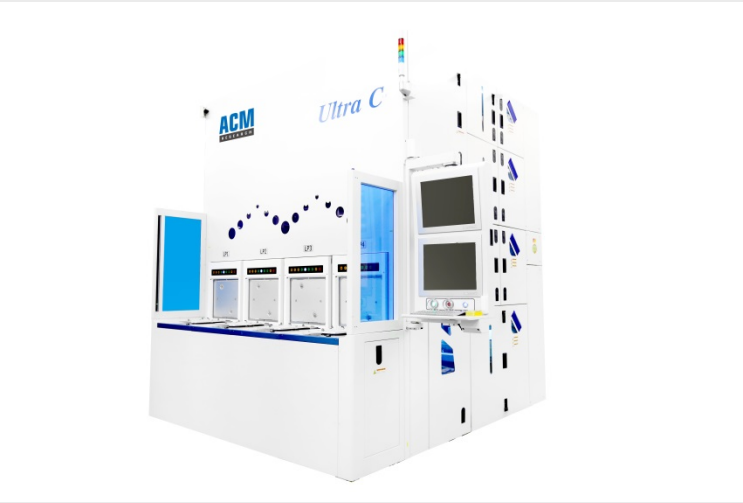
- ✓ Backside metal removal or RCA clean
- ✓ Backside silicon etching and film removal
- ✓ 200mm or 300mm ultra-thin wafers and bonding wafers

Ultra C wb

Automated Wet Bench

- ✓ Batch cleaning of up to 50 wafers
- ✓ Modular design and small footprint
- ✓ Environmentally friendly
- ✓ Low cost of ownership

Ultra C s

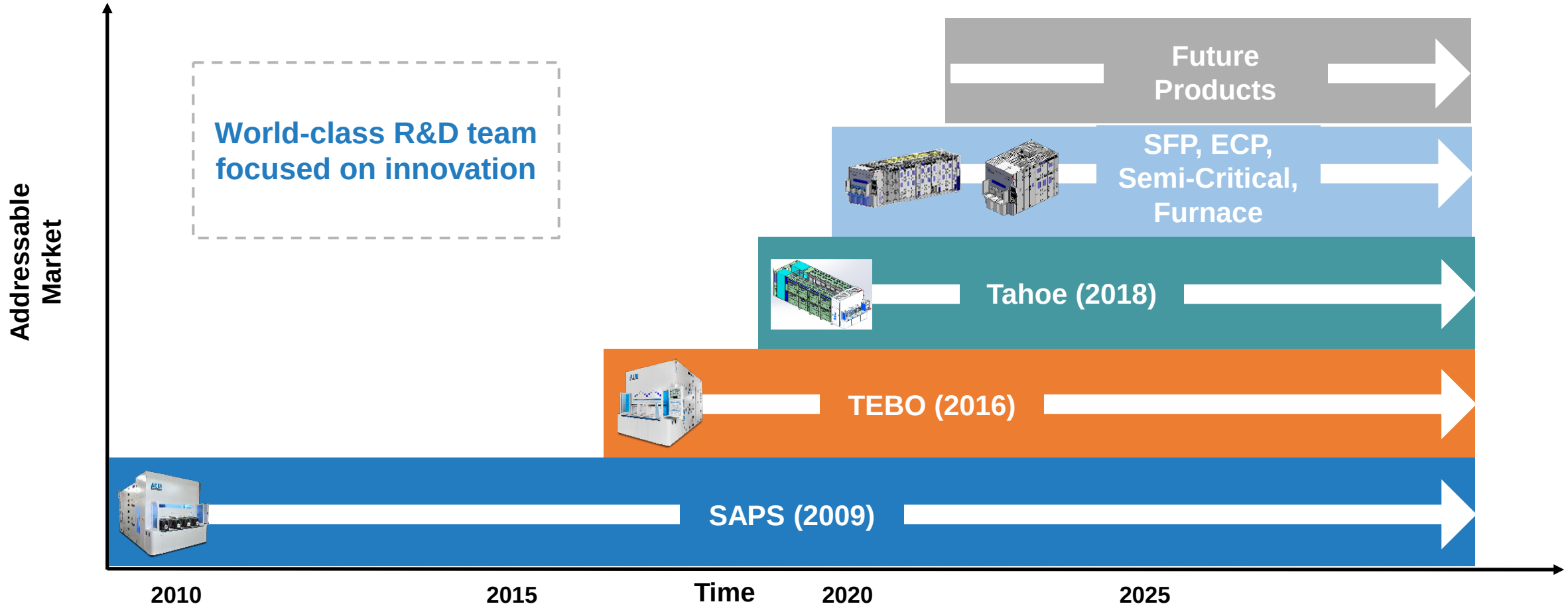


Scrubber

- ✓ Advanced dual-fluid (gas and liquid) spray cleaning technique
- ✓ Eight chambers for 300mm IC applications
- ✓ Flexibility, small footprint and high throughput

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, and SFP, ECP, Furnace and Semi-Critical tools more than doubles our market opportunity



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 2019 Revenue %: 28% (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[3]
- ACM 2019 Revenue %: 27% (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[4]
- ACM 2019 Revenue %: 20% (primarily DRAM)

- 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[5]

New DRAM Customer

- New China-based entrant to DRAM industry
- Ordered 12-Chamber SAPS-V tool for evaluation
- ACM delivered first-tool in Q4 2019

Back-End Customers

- 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[6]
- Global customer base with exposure to the U.S., Western Europe and Asia

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

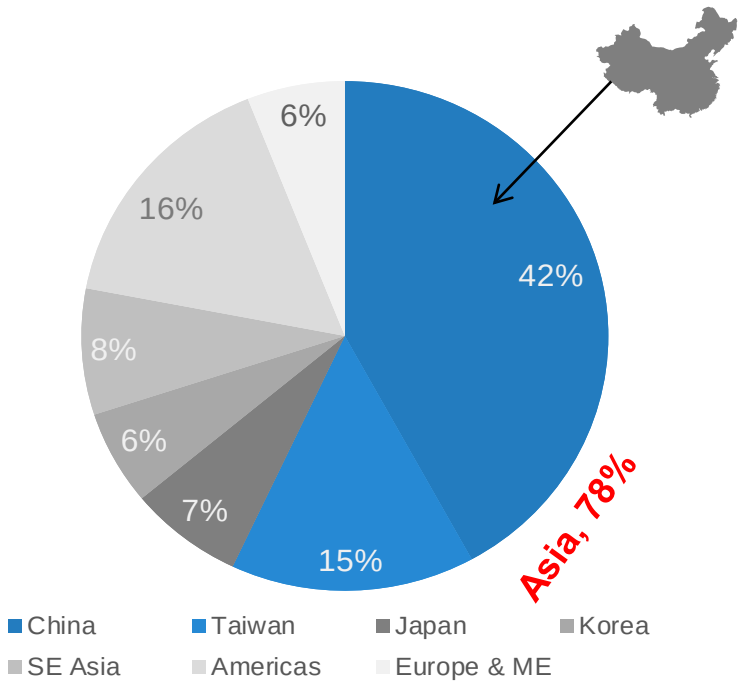
(1) Source: Nikkei Asian Review. (2) Source: YMTC Press Release. (3) Source: HLMC Press Release. (4) Source: Reuters. (5) Source: AnandTech. (6) Source: JCAP Company Profile. (7) Source: Electronics Weekly. (8) Source: TFME website.

Well-Positioned to Participate in Asia Fab Investments

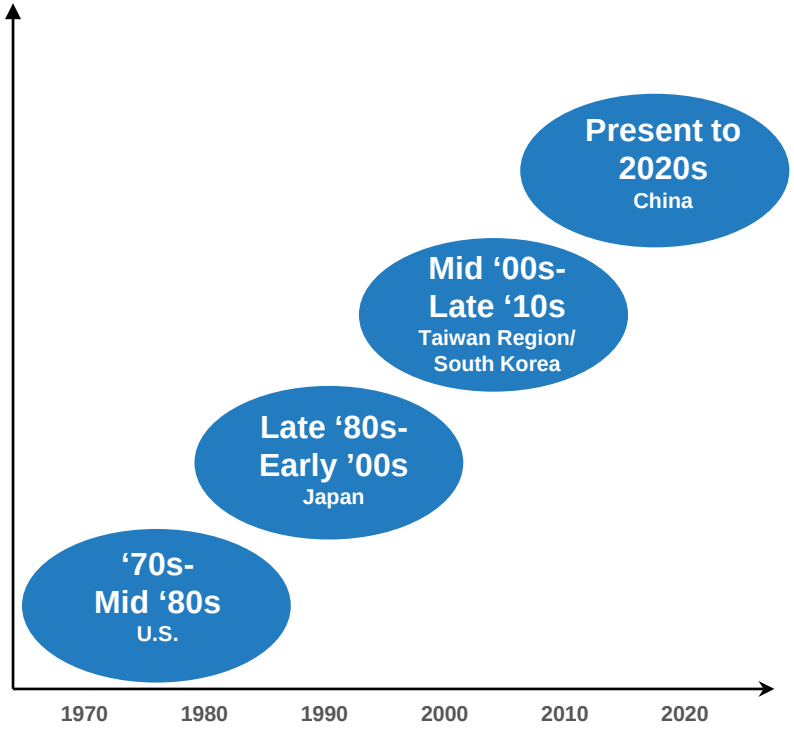
Semiconductor Industry Development

($ 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	Taiwan Region	$14.1	4%
2	China	$13.1	19%
3	South Korea	$11.9	11%
4	North America	$7.7	15%
5	Japan	$6.6	9%
	Rest of World	$6.5	3%

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.

Shanghai Manufacturing Facilities – Existing and Planned

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

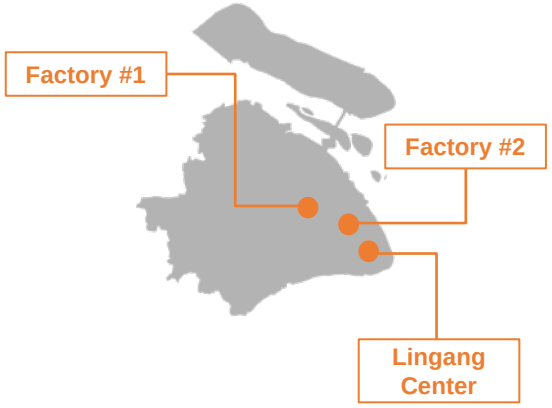
Facility #2

- 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 sub-assembly, component inventory and manufacturing related offices
- 2nd floor available for additional expansion

Factory #3

- Finalized agreement for land rights for R&D and production facility in Lingang region of Shanghai in May 2020
- Under the agreement, ACM Shanghai plans to build a development and production facility approximately 30 miles from ACM Shanghai's headquarters in Zhangjiang.

Shanghai Locations



Q1 2020 Highlights

- **Solid Q1 Results:**
  - Revenue and shipments were impacted by COVID-19 related shutdowns
  - $24.3 million revenue, up 19% from Q1 2019; Total shipments of $12 million
  - 42.0% GAAP gross margin and 5.0% GAAP operating margin
  - 42.2% non-GAAP gross margin and 7.8% non-GAAP operating margin
  - $3.8 million cash flow from operations

- **Key Operational Progress:**
  - First tool acceptance and repeat order for Ultra-C Tahoe at lead customer
  - Introduced family of Ultra-C Wet Cleaning Tools to expand wet-cleaning opportunity
  - Entered dry cleaning market with introduction of the Ultra Furnace Platform
  - Appointed industry veteran as new VP of Sales for North America

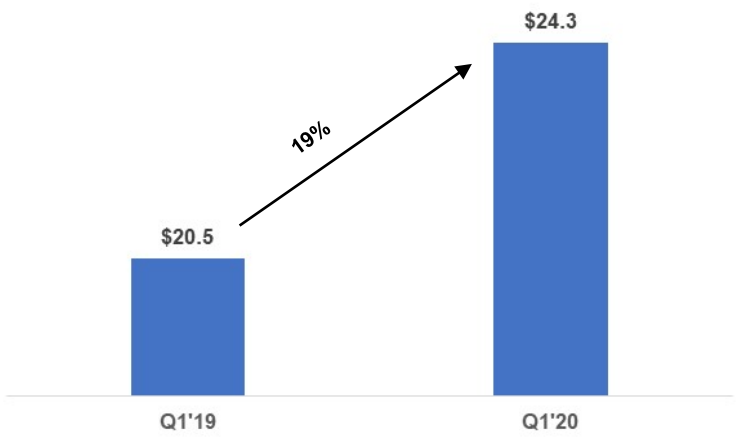
- **Strategic Update:**
  - Finalized agreement for land rights for R&D and production facility in Lingang region of Shanghai in May 2020
  - On track to submit application for STAR Market IPO in mid-2020

- **Ended Q1 with $52 million of cash**
  - Additional $59 million in proceeds from ACM Shanghai held as restricted cash pending STAR Market application

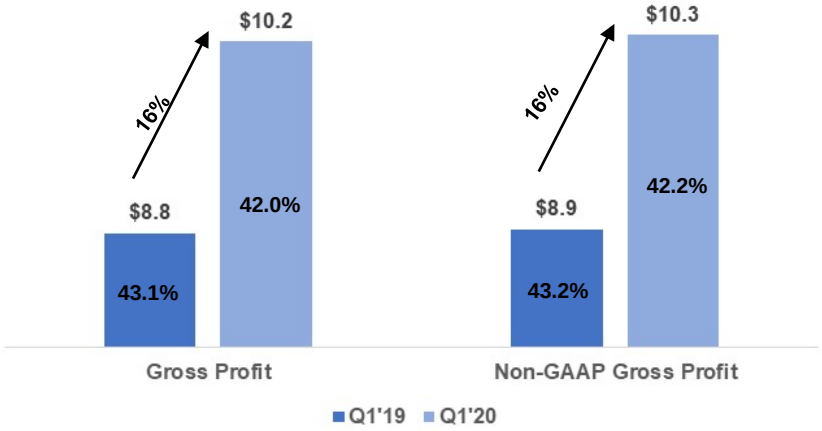
Q1’20 Financial Results

$ Millions, non-GAAP gross profit and operating profit

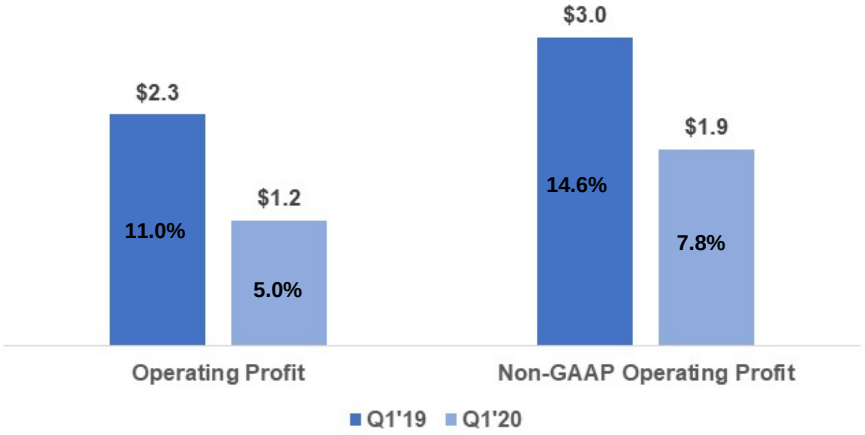
Revenue



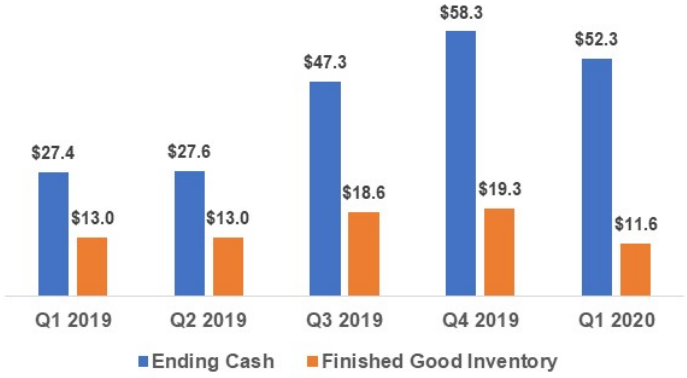
Gross Profit



Operating Profit



Balance Sheet Data*

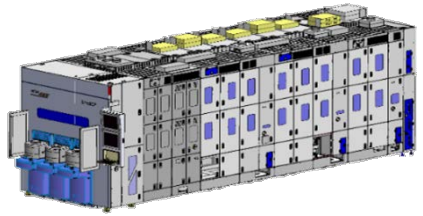


** Finished goods inventory represents ‘demo-to-sales’ product which have been delivered to customers for evaluation. These products are carried at cost until ownership is transferred.*

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

- Gaining share in the ~$3B wafer cleaning market (1)
- Innovative, patent-protected tools address critical challenges in leading-edge IC manufacturing
- Tier 1 global customer base in DRAM, NAND and foundry / logic
- New product introductions have more than doubled SAM
- China-based production with U.S. headquarters offers significant competitive advantage
- Expanding margins and healthy balance sheet

(1) Source: Gartner – "Forecast: Semiconductor Wafer Fab Manufacturing Equipment (Including Wafer-Level Packaging), Worldwide, 4Q19 Update" (December 2019). See "Market Data" on page 2.

GAAP to Non-GAAP Reconciliation (1)

($ in millions)

	2017	2018	2019	3 months Ended 3/31/2020
GAAP Income from Operations	$0.7	$6.5	$17.8	$1.2
Plus: Stock-based Compensation	$1.6	$3.4	$3.6	$0.7
Adjusted Income from Operations	**$2.3**	**$9.8**	**$21.4**	**$1.9**
GAAP Net Income (Loss)	($0.3)	$6.6	$19.5	$2.0
Plus: Interest Expense (Income), Net	$0.3	$0.5	$0.4	($0.2)
Plus: Income Tax Expense	$0.5	$0.8	($0.5)	$0.3
Plus: Depreciation and Amortization	$0.3	$0.4	$0.8	$0.2
Plus: Stock-based Compensation	$1.6	$3.4	$3.6	$0.7
Adjusted EBITDA	**$2.4**	**$11.6**	**$23.7**	**$2.9**
GAAP Net Income (Loss)	($0.3)	$6.6	$19.5	$2.0
Plus: Stock-based Compensation	$1.6	$3.4	$3.6	$0.7
Adjusted Net Income	**$1.3**	**$9.9**	**$23.0**	**$2.7**

Source: Company filings.

GAAP to Non-GAAP Reconciliation (2)

($ in millions)

	Three Months Ended March 31,			
	GAAP		Non-GAAP	
	2020	2019	2020	2019
	(dollars in thousands)			
Revenue	$ 24,348	$ 20,479	$ 24,348	$ 20,479
Gross margin (1)	42.0%	43.1%	42.2%	43.2%
Income from operations (1)	$ 1,218	$ 2,251	$ 1,907	$ 2,995
Net income attributable to ACM Research, Inc. (1)	$ 1,705	$ 1,857	$ 2,394	$ 2,601
Basic EPS	$ 0.09	$ 0.12	$ 0.13	$ 0.16
Diluted EPS	$ 0.08	$ 0.10	$ 0.11	$ 0.14
Shares included in the basic EPS	18,120	16,045	18,120	16,045
Shares included in the diluted EPS	21,067	18,225	21,067	18,225

(1) Non-GAAP financial measures exclude stock-based compensation.

GAAP to Non-GAAP Reconciliation (3)

	Three Months Ended March 31,					
	2020			2019		
	Actual (GAAP)	SBC	Adjusted (Non-GAAP)	Actual (GAAP)	SBC	Adjusted (Non-GAAP)
	(In thousands)					
Revenue	$ 24,348	$ -	$ 24,348	$ 20,479	$ -	$ 20,479
Cost of revenue	(14,120)	(45)	(14,075)	(11,653)	(30)	(11,623)
Gross profit	10,228	(45)	10,273	8,826	(30)	8,856
Operating expenses:						
Sales and marketing	(3,005)	(94)	(2,911)	(1,869)	(34)	(1,835)
Research and development	(3,677)	(187)	(3,490)	(2,765)	(86)	(2,679)
General and administrative	(2,328)	(363)	(1,965)	(1,941)	(594)	(1,347)
Income from operations	$ 1,218	$ (689)	$ 1,907	$ 2,251	$ (744)	$ 2,995
Net income attributable to ACM Research, Inc.	$ 1,705	$ (689)	$ 2,394	$ 1,857	$ (744)	$ 2,601