Getting Ready for the Next Level of Growth

Ready for the new normal: How Comet PCT prepares for the continued strong demand in the semiconductor industry

Michael Kammerer, President PCT
Explosive Growth of Data Drives Semiconductor Industrie

Autonomous Vehicles

Internet of Things

Industry 4.0

Augmented Reality

Virtual Reality

Cloud Computing

Digital Revolution

Artificial Intelligence

Big Data
**Inflections Happening Now**

**End Markets**
- Increasing silicon content in smartphones
- Explosive growth of data (4k video, IoT, …)
- Display as a key differentiator
- New categories (VR/AR, AI, smart vehicles, …)

**OEM Markets**
- 10/7/5 nm Foundry
- 3D NAND
- Patterning
- OLED
- China

**Materials Enabled Inflections**

*Source: Applied Materials*
New Requirements Chip Manufacturing

**Changed Chip Design**

**Market requirements**
- less energy consumption
- improved chip performance

**3D Structures**
- Structure size < 10 nm

**Changing Processes**

**Challenges**
- ensure digital behavior of device
- ensure geometrical gap distances

**Depositing/etching have become more challenging**

**New tasks for subsystems**

- more precise RF Power
- more repeatable RF Power

**Increasing complexity = rising capital intensity**
Comet products for the precise control of plasma processes

High Performance RF Solutions

Challenges

Of the highly sensitive plasma processes:

- High aspect ratio
- Demanding materials

The more important become precision, reliability, high accuracy and repeatability.

Comet Impedance Matching Networks

Customized for best performance

- Optimized for every application
- Quality and design to cost
- Super short development cycles

Higher lifetime and speed

- Using Comet high quality capacitors
- Higher speed due to new software algorithms

Comet RF Generator cito Plus

Accurate, highly repeatable

- Covers the most required RF frequencies and power levels
- Accurate power measurement
- Precision controlled power delivery
- Extremely fast reacting, modular interfaces
- Repeatability in multistep recipes and cyclical processes
Comet products for the precise control of plasma processes

High Performance RF Solutions

Comet Vacuum Capacitors
For sophisticated applications and production processes
- Broadest selection of capacitance, power, voltage and drive systems
- Produced according highest quality standards

Growth drivers
- Semi: use of vacuum capacitors in impedance matching networks
- Display: most promising growth market
  - growing applications (mobile devices, OLED volume ramp, larger TV screen sizes, 8K, growing demand in China)
  - Need for low frequencies and high voltages. Results in use of larger (more expensive) vacuum capacitors

Committed to the future
In recent years, Comet products have been designed in today’s standard equipment for many reasons.
Innovation / collaboration with our customers is key for future success.
Collaboration and Innovation is Key

Global inflections are enabled by new collaboration platforms

- New forms of collaboration: industries overlap, merge or are formed completely new
- Efficient collaboration requires new forms of partnership
- Vertical integration with customers has gained importance

Comet invests a lot in the collaboration with business partners and was awarded with three prices in 2017 (Applied Materials, Amec, Naura)
Primary investments in the future

<table>
<thead>
<tr>
<th>Location</th>
<th>Innovation</th>
<th>Operations</th>
<th>People</th>
</tr>
</thead>
</table>
| Flamatt, CH| Smart Lab  
Development of new RF & Process Power Control System | Expansion of vacuum capacitor production        | Growth from 336 employees in 2015 to 500 in 2017 |
| San Jose, US| Lab One  
Plasma diagnostics and control, like special function analysis | Previous building will be used only for operations / QS |                             |
|            | R&D Laboratory  
New, separate R&D facilities with laboratory / office space | Expansion within existing building               |                             |
| Shanghai, CN|                                                |                                                 |                             |
Beyond 2020

Future RF Control System

Outpace state-of-the-art technology
- Development of a modular, highly flexible RF & process power control system
- This new platform will increase accuracy and repeatability of wafer fab equipment significantly.
- Platform system allows super-fast development of new products
- Permits sale of complete RF control systems with intelligently coordinated products.

Requirements
- Ultra-modern lab space
- A team of experienced RF specialists with know-how in plasma applications and embedded software.

Key Features
- Real time statistics and data analysis improve yield.
- High-speed communication between matching network and generators.
- Higher measurement accuracy.
Ramp will go on!

**Reasons why**

| The new technologies require more micro-chips | More fabs are built, especially in Asia |
| The number of process steps in micro-chip production has risen | Superproportional growth for power supply business |
| Overdesign for yield/design reasons | More equipment is necessary |
| Comet is globally engaged with the market leaders | Collaboration |

*Source: World Fab Forecast report, August 2017, SEMI*
Promising Future
Comet’s involvement in plasma applications in Wafer Fab Equipment (WFE) spending

Main WFE Segments

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>% of WFE</th>
<th>Revenue 2017 ($ bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithography</td>
<td>23%</td>
<td>$ 10.7</td>
</tr>
<tr>
<td>CMP</td>
<td>4%</td>
<td>$ 1.7</td>
</tr>
<tr>
<td>Implant</td>
<td>2%</td>
<td>$ 1.2</td>
</tr>
<tr>
<td><strong>Deposition</strong></td>
<td><strong>25%</strong></td>
<td><strong>$ 12.0</strong></td>
</tr>
<tr>
<td>Etch</td>
<td>30%</td>
<td>$ 14.2</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>13%</td>
<td>$ 6.2</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>$ 1.2</td>
</tr>
</tbody>
</table>

Source: VLSI, October 2017

- Comet works for the largest segments
- Plasma segments comprise 55% of all Wafer Fab Equipment spending
- Comet is involved in all plasma segments
Growth Far Above Average

Comet Plasma Control Technologies

3-year CAGR

Comet

WFE spend

(Source: Gartner)
Thank you very much for your attention.

Questions?