2023-2024
Critical Materials Report™
Silicon Parts

Supply-Chain & Market Analysis
a Critical Materials Report™

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RESEARCH METHODOLOGY

TECHCET employs subject matter experts having first-hand experience within the industries which they analyze. Most of TECHCET's analysts have over 25 years of direct and relevant experience in their field. Our analysts survey the commercial and technical staff of IC manufacturers and their suppliers, and conduct extensive research of literature and commerce statistics to ascertain the current and future market environment and global supply risks. Combining this data with TECHCET's proprietary, quantitative wafer forecast results in a viable long-term market forecast for a variety of process materials.

READER'S NOTE

This report represents the interpretation and analysis of information generally available to the public or released by responsible agencies or individuals. Data was obtained from sources considered reliable. However, accuracy or completeness is not guaranteed.

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ANALYST BIOGRAPHY

Shaoyan(Yan) Luo – Jr. Analyst of TECHCET in charge of identification of economic trends, market research and forecast modeling. She is tri-lingual in English, Chinese and Korean and works to support the Company's customers from Far East to West. She has a B.S. degree in Mathematics/Economics from the University of California at San Diego.

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ANALYST BIOGRAPHY

Lita Shon-Roy is President/CEO and founder of TECHCET. Ms. Shon-Roy has worked throughout the semiconductor supply chain, leading strategy and business development for chip companies, equipment OEMs, and material suppliers for over 30 years. Her experience spans from process development of flat panel displays to strategic marketing of metal organic precursors and specialty gases. She has been implemental in spearheading business strategies and growth opportunities for companies such as RASIRC/Matheson Gases and IPEC, Air Products/Schumacher, and managed marketing teams at Brooktree/Rockwell, and Hughes Aircraft.

Ms. Shon-Roy has advised start-ups and fortune 500 companies, authored hundreds of articles and reports on materials markets and supply chain issues and is considered an expert in electronic materials marketing and business development.

She holds Advisory roles at the following companies: Alixlabs, PurityResource, and the Krach Institute Center for Technology Diplomacy.

Her academic background includes an M.B.A. from the California State University Dominguez Hills, an M.S. in Solid-state Physics, from USC, and a B.S. in Chemical Engineering from UC San Diego.

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1. SCOPE, PURPOSE, METHODOLOGY

- **Scope:** This Critical Materials Report™ primarily focuses on the markets of silicon parts used in semiconductor process equipment, including silicon base materials and silicon equipment components for wafer process tools used for semiconductor device manufacturing. These parts are considered consumables, given that they are eventually require replacing after repeated use. Details on the supply-chain from high purity poly-silicon, base material manufacturers, and silicon fabricators are provided.

- **Purpose:** This report aims to provide an overview to the above scope silicon material and parts supply chain, serving the semiconductor industry. The report includes information on the market landscape of silicon parts suppliers in addition to their dependency on raw materials. This information about this critical material is essential in the running of the semiconductor wafer fabs across the world. The goal is to annually (or bi-annually) track the state of the industry; the health of the supply and demand; to pinpoint any shortcomings or issues faced by the industry; and to provide a guidance for purchasing and industry quality improvement decisions. Business and technical trends relating to changes in the semiconductor industry are also provided to help the reader understand the drivers behind the silicon parts market. We hope to provide a dialog and feedback opportunities for related stakeholders to fine-tune and better manage the supply ups and downs.

- **Methodology:** We track micro-economic and macro-economic trends pertaining to the semiconductor industry and track overall industry trend and needs, equipment supply and demand situation, deduction towards the silicon material requirement, and supplier/fabricators situation one by one. From this vantage point, we check the suppliers/fabricators and the base material company information, and then the raw materials market information. Included in our work is an analysis of public information, website information, supplier interviews, supplier surveys, supplier peer-data cross-checking, and reference comparison. In addition, we conduct a material base usage calculation with respect to a demand and supply micro-economic analysis. We then conduct a forward and backward sweep of the forecast until data is in sync. In the meantime, for the data points that are missing, we use past historic, forward-looking data, and peer data so to extrapolate from three different levels of cross-checking. This provides us an estimation based on judgment from industry experience. Information provided was generated through a combination of primary and secondary market research supported by TECHCET's database of market information on semiconductor equipment consumables and process materials.

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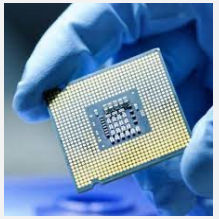
1.1 Supply Chain & Value Chain of Silicon Parts

The value chain of silicon equipment parts starts with polysilicon providers that supply to ingot makers. The ingot is then fabricated into parts before being sold to OEMs or Chip makers, as shown below. This report touches upon each segment of this value chain, with a primary focus on Parts Fabrication.

Raw Material Polysilicon	**Ingot Makers**	**Parts Fabricators**	**OEMs**	**Chip Makers**
OCI	ThinkOn	Silfex	Lam Research	TSMC
Hemlock	Wacker	Hana Materials	TEL	Samsung
Mitsubishi Materials	Ferrotec (captive)	Coorstek	AMAT	Intel
REC	Silfex (captive)	WorldEx	Hitachi, etc.	Micron, etc.
Tokuyama	WorldEx (captive), etc.	Mitsubishi Materials, etc.		
Wacker				







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1.2 Overview of Other TECHCET CMR™ Reports

TECHCET produces electronic material supply chain reports each year as one of its functions for the Critical Materials Council. Reports to be published in 2020 can be found at www.techcet.com and are listed in the table:

TECHCET's Critical Materials Reports™	
1	CMP Consumables (Pads & Slurry)
2	CMP Equipment Ancillaries (Conditioners, Filters, etc.)
3	CVD /ALD Hi K Precursors
4	CVD DIELECTRIC Precursors
5	Equipment Components – Quartz
6	Equipment Components – Silicon
7	Equipment Components – SiC/Ceramics
8	Gases - Electronic Specialty, Bulk & Rare Gases
9	Metal Plating Chemicals
10	Photoresists, Ancillaries & Extension Materials
11	Sputtering Targets
12	Wafers: Silicon, SOI
13	SiC Wafers & Manufacturing
14	Wet Chemicals / Specialty Cleans
15	Special Reports: Impact of US Expansions on Wet Chemicals Supply Chains

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