

ELECTRONIC GASES

Supply-chain & Market Analysis
A Critical Materials Report™

Prepared By:

Jonas Sundqvist, PhD

TEHCET CA LLC

11622 El Camino Real #100

San Diego, CA 92130

www.TEHCET.com

info@TEHCET.com



Electronics Materials Information

TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	10		
1.1	ELECTRONIC GASES BUSINESS GROWTH OVERVIEW	11	3.2	SEMICONDUCTOR SALES TRENDS 51
1.2	ELECTRONIC GASES MARKET TRENDS	14	3.3	ELECTRONIC GOODS MARKET 52
1.3	ELECTRONIC GASES TECHNOLOGY TRENDS	18	3.3.1	SMARTPHONES 53
1.4	5-YEAR ELECTRONIC GASES FORECAST	25	3.3.2	AUTOMOTIVE 54
1.5	COMPETITIVE LANDSCAPE	28	3.3.3	SERVERS / IT 59
1.6	EHS ISSUES/CONCERNS	34	3.3.4	PCS/TABLETS 61
1.7	ANALYST ASSESSMENT	38	3.4	SEMICONDUCTOR INDUSTRY FORECASTS 62
2	SCOPE, PURPOSE AND METHODOLOGY	40	3.4.1	SEMICONDUCTOR UNITS GROWTH FORECAST 63
2.1	SCOPE	41	3.4.2	EQUIPMENT SPENDING AND FAB AND CAPITAL INVESTMENTS 64
2.2	PURPOSE	42	3.4.3	OVERALL CHINA MARKET TRENDS 65
2.3	METHODOLOGY	43	3.4.4	WAFER START FORECAST 66
2.4	OVERVIEW OF OTHER TECHCET CMR™ REPORTS	44	3.5	SEMICONDUCTOR INDUSTRY MARKET OUTLOOK SUMMARY 70
3	SEMICONDUCTOR INDUSTRY MARKET OUTLOOK	45	3.6	INDUSTRIAL GAS MARKET 72
3.1	SEMICONDUCTOR INDUSTRY MARKET STATUS & OUTLOOK	46	3.6.1	INDUSTRIAL GAS MARKET 2019 73
3.2	WORLDWIDE ECONOMY	48	3.6.2	REPORTED REVENUE BY GAS/CHEMICAL COMPANIES 74
3.2.1	SEMICONDUCTOR INDUSTRIES TIES TO THE GLOBAL ECONOMY	50	3.6.3	CHANGES AND SHIFTS IN THE INDUSTRIAL GAS MARKET 75
			3.6.4	VERSUM MATERIALS TAKE OVER BY MERCK 76
			3.6.5	M&A ACTIVITIES 77

TABLE OF CONTENTS

4	ELECTRONIC GASES TRENDS	81		
4.1	FAB MATERIAL SUPPLY/DEMAND	82	4.4.1	EUROPE 127
4.1.1	ELECTRONIC GASES MARKET SIZE AND GROWTH	83	4.4.2	NORTH AMERICA 128
4.1.2	HELIUM - SUPPLY AND DEMAND	86	4.4.3	ASIA 129
4.1.3	NEON – SUPPLY AND DEMAND	90	4.5	EHS AND LOGISTIC ISSUES (AND IF RELEVANT, PACKAGING ISSUES) 131
4.1.4	XENON & CRYPTON SUPPLY AND DEMAND	92	4.5.1	GREENHOUSE GASES 132
4.1.5	WF ₆ & NF ₃ DEMAND DRIVERS	96	4.5.2	FLUORINATE GAS REGULATIONS 136
4.2	RAW MATERIAL SHORTAGES AND SUPPLY CHAIN CONSTRAINTS	105	4.5.3	GWP USE, CONTROL & MITIGATION 139
4.2.1	HELIUM	106	5	SUPPLIER MARKET LANDSCAPE 142
4.2.2	NF ₃	110	5.1	M&A ACTIVITY 143
4.3.3	TUNGSTEN	112	5.1.1	CHANGES AND SHIFTS INT THE INDUSTRIAL GAS MARKET 144
4.3	TECHNICAL DRIVERS / MATERIAL CHANGES AND TRANSITIONS	116	5.1.2	VERSUM TAKE OVER BY MERCK 145
4.3.1	WAFER START FORECAST AND LEADING EDGE NODES	117	5.1.3	AQUISITIONS 146
4.3.2	LEADING EDGE LOGIC	118	5.2	NEW PLANTS AND NEW ENTRANTS 150
4.3.3	MEMORY – DRAM & 3DNAND	120	5.2.1	ASU PLANTS – USA 151
4.3.4	GASES USED IN FLAT PANEL DISPLAY (FPD)	124	5.2.2	RECENT ASU ANNOUNCEMENTS 152
4.4	COMMENT ON REGIONAL TRENDS/DRIVERS	126	5.2.3	AIR PRODUCTS MAJOR PROJECTS 154
			5.2.4	HELIUM PROJECTS 155

TABLE OF CONTENTS

5.3	PLANT CLOSURES AND PRODUCT DISCONTINUATIONS	158
5.3.1	PLANT CLOSURES AND PRODUCT DISCONTINUATIONS	159
5.3.2	REPORTED ACCIDENTS	160
5.4	NEW ENTRANTS	161
5.5	SUPPLIERS OR PARTS/PRODUCT LINE THAT ARE AT RISK OF DISCONTINUATIONS	163
5.6	PRICING TRENDS	164
5.7	MARKET SIZE AND FORECAST	166
5.7.1	INDUSTRIAL GAS MARKET 2019	167
5.7.2	ELECTRONIC GAS MARKET SIZE AND GROWTH	168
6	SUB TIER MATERIAL SUPPLY CHAIN	169
6.1	RAW MATERIAL SOURCES	170
6.1.1	SUPPLIER LIST	171
6.2	RAW SUPPLY CHAIN DISRUPTIONS	172
6.3	RAW MATERIAL PRICING TRENDS	174
6.3.1	TUNGSTEN MINERAL (APT)	175
6.3.2	CRUDE HELIUM	176

7	ELECTRONIC GASES SHARED BY MULTIPLE INDUSTRIES	177
7.1	GASES USED BY MULTIPLE INDUSTRIES	178
7.1.1	SPECIALTY GAS INDUSTRY MATIX	179
7.1.2	GASES USED FOR SEMICONDUCTOR DEVICE MANUFACTURING	180
7.1.3	GASES USED IN THE DISPLAY INDUSTRY	181
7.2	SUPLPLIER LISTING BY GAS TYPE	183
8	SUPPLIER PROFILES & FINANCIALS	189

Air Liquide (Maker, Purifier, Supplier)	Linggas Limited (Purifier, Supplier)
Air Products (Maker, Purifier, Supplier)	Niacet (Maker, Purifier)
Air Water (Maker)	Messer Group (Gases for life)-
Cryoin Engineering (Purifier/ Suppliers)	Numat (Maker)
DuPont (Maker, Purifier, Supplier)	Peric-718 (Maker, Purifier, Supplier)
Electronic Fluorocarbons (Purifier, Supplier)	Showa Denko K.K. (Maker, Purifier, Supplier)
Gas Innovations (Maker)	SK Materials (Maker, Purifier, Supplier)
Hangzhou Fortune (Maker, Purifier, Supplier)	Spec Gas International Holdings (SGIH) (Maker)
Hyosung Corporation (Maker)	Sumitomo Seika Chemicals Co., Ltd. (Maker, Purifier)
Kaimeite (Maker, Purifier, Supplier)	Taiyo Nippon Sanso/Matheson (Maker, Purifier, Supplier)
Kanto Denka Kogyo (Maker, Purifier, Supplier)	Versum Materials/Merck (Maker, Purifier, Supplier)
Linde (Maker, Purifier, Supplier)	Wonik Materials Co. Ltd.
Praxair (now a wholly owned subsidiary of Linde)	Yingde Gases

FIGURES & TABLES

TABLE OF FIGURES

Figure 1: Electronic Gas TAM Forecast	13	Figure 19: Semiconductor Chip Applications	52
Figure 2: TECHCET Wafer Usage by Device Types and Node		Figure 20: Mobile Phone Shipments WW Estimates	53
200mm Equip (M Wafers / Year)	19	Figure 21: Oil Price per Barrel US WTI	55
Figure 3: Semiconductor Technology Landscape	20	Figure 22: Semiconductor Spend per Vehicle Type	57
Figure 4: IMEC 2019 Logic Roadmap	20	Figure 23: Semiconductor Content by Automotive Application	58
Figure 5: Logic/Foundry Process Roadmaps (for volume production)	21	Figure 24: Semiconductor Revenue Growth Forecasts (as of April 19, 2020)	62
Figure 6: 3DNAND Technology Roadmap	22	Figure 25: Semiconductor Units History and Forecast	63
Figure 7: Stack Capacitor DRAM Technology Evolutions	23	Figure 26: 200 mm Wafer Capacity Forecast	66
Figure 8: Electronic Market Growth, US\$ M	26	Figure 27: 2020/ 2019 Growth Estimates for 3DNAN, DRAM and Logic Devices (advanced nodes and leading edge)	68
Figure 9: Total Industrial Gas Market 2019, USD 89 Billion	29	Figure 28: 2020 Outlook	71
Figure 10: Gas Companies –Total Revenue 2019	30	Figure 29: Total Industrial Gas Market 2019, US\$89 Billion	73
Figure 11: Reported Revenue by Gas/Chemical Companies 2019	30	Figure 30: Reported Revenue by Gas/Chemical Companies 2019	74
Figure 12: NF3 Capacity Market Share 2019	32	Figure 31: NF3 Capacity Market Share 2019	76
Figure 13: WF6 Capacity Market Share 2019	32	Figure 32: WF6 Capacity Market Share 2019	76
Figure 14: Gas Companies – Total Revenue 2019	33	Figure 33: Electronic Market Growth, M USD	83
Figure 15: 2020 Outlook	36	Figure 34: Electronic Gas TAM Forecast	84
Figure 16: Gas Companies – Total Revenue 2019	39	Figure 35: He WW Supply and Demand	86
Figure 17: Global Economy and the Electronics Supply Chain (2019)	50	Figure 36: He WW Supply	86
Figure 18: Worldwide Semiconductor Sales	51		

FIGURES & TABLES

TABLE OF FIGURES

Figure 37: 2020 He Market Share - WW Regions	87	Figure 57: IMEC 2019 Logic Roadmap	118
Figure 38: 2025 He Market Share – WW Regions	87	Figure 58: Logic/Foundry Process Roadmaps (for volume production)	119
Figure 39: US Grade-A Helium Usage 2019	88	Figure 59: Stack Capacitor DRAM Technology Evolutions	120
Figure 40: Total Neon Demand vs. Supply	90	Figure 60: 3DNAND Lateral Scaling	121
Figure 41: Total Xenon Demand vs. Supply	92	Figure 61: Schematic Views of 3DNAND	121
Figure 42: Total Krypton Demand vs. Supply	94	Figure 62: 3DNAND Layers, Stacking, and Bits/Cell	122
Figure 43: Krypton Net System Sales Breakdown (quarterly)	95	Figure 63: 3DNAND Technology Roadmap	123
Figure 44: WF6 & NF3 Demand 2019	96	Figure 64: Flat Panel Display	124
Figure 45: TECHCET 3DNAND Wafer Forecast	96	Figure 65: FDP Production 2019 (334 M m2)	125
Figure 46: NF3 Industry Demand	98	Figure 66: Trends in Atmospheric SF6	133
Figure 47: NF3 Capacity Market Share 2019	99	Figure 67: Trends in Atmospheric NF3	134
Figure 48: NF3 Forecast	100	Figure 68: Trends in Atmospheric CF4	135
Figure 49: Tungsten Use by Industry	102	Figure 69: Semiconductor Industry Contribution	139
Figure 50: WF6 Capacity Market Share 2019	103	Figure 70: NF3 Capacity Market Share 2019	145
Figure 51: WF6 Forecast	104	Figure 71: WF6 Capacity Market Share 2019	145
Figure 52: NF3 Use	110	Figure 72: ASU Plants – USA	151
Figure 53: Tungsten Extraction	113	Figure 73: Air Products – Major Products	154
Figure 54: Tungsten Mine Production (USGS 2015-2020)	114	Figure 74: Total Industrial Gas Market 2019, US \$89 Billion	167
Figure 55: TECHCET Wafer Usage by Device Types and Node 200mm Equip	117	Figure 75: Electronic Gas TAM Forecast	168
Figure 56: Semiconductor Technology Landscape	118	Figure 76: Specialty Gas Type by Share	182
		Figure 77: Bulk Gas Type by Share	182

FIGURES & TABLES

LIST OF TABLES

Table 1: Asset Change Due to Linde-Praxair Merger	15	Table 14: Asset Change due to Linde-Praxair merger	75
Table 2: M&A Activities	16	Table 15: Electronic Gas Market Size and Growth	83
Table 3: Electronic Gas Market Size & Growth	26	Table 16: 5-Year Specialty Gas Supply & Demand	85
Table 4: 5-Year Electronic Gas Supply & Demand	27	Table 17: Asset Change due to Linde-Praxair merger	144
Table 5 COVID-19 Lockdowns and Restrictions by Region (April 2020)	35	Table 18: Helium Projects	155
Table 6: Global GDP and Semiconductor Revenues*	48	Table 19: Reported Accidents	160
Table 7: IMF World Economic Outlook*	49	Table 20: Supplier List, Financials and Profiles	171
Table 8: 2020 Auto Industry Growth Impact Factors	56	Table 21: Specialty Gas Industry Matrix	179
Table 9: Data Center Systems and Communication Services Forecast 2020	60	Table 22: Gases Used in FPD Manufacturing	181
Table 10: Worldwide Device Shipments by Device Type, 2020-2022 (Jan 2020)	61	Table 23: Hydrides Suppliers	184
Table 11: 2019 Investment Plans for Selected Device Companies (as of March 2020)	64	Table 24: Silicon Suppliers	185
Table 12: China Fabs Capabilities Status	65	Table 25: Etchant Gas Suppliers	186
Table 13: 2020/ 2019 Growth Estimates for 3DNAN, DRAM and Logic Devices (advanced nodes and leading edge)	67	Table 26: Deposition/Misc.Gas Suppliers	187
		Table 27: Bulk Gas Suppliers	188

GASES SUPPLIER PROFILES

1. Air Liquide (Maker, Purifier, Supplier)	182
1.1. Air Liquide-Company Overview	182
1.2. Business Segments	183
1.3. Financial Overview	183
1.4. News	184
1.5. Key Customers	184
1.6. Manufacturing Locations, Capabilities, and Accreditations	185
1.7. JVs and Partnerships	185
1.8. Sales Reps and Distributors by Region	186
1.9. TECHCET Analyst Assessment	186
1.10. Reference	186
2. Air Products (Maker, Purifier, Supplier)	187
2.1. Air Products-Company Overview	187
2.2. Business Segments	187
2.3. Financial Overview	187
2.4. News	188
2.5. Key Customers (especially electronics /chip companies)	189
2.6. Manufacturing Locations, Capabilities, and Certifications (of electronic materials & related plants)	189
2.7. JVs and Partnerships	190
2.8. Sales Reps and Distributors by Region	190
2.9. TECHCET Analyst Assessment	191
2.10. Reference	191
3. Air Water (Maker)	192
3.1. Air Water Inc. - Company Overview	192
3.2. Business Segments	192
3.3. Financial Overview	192
3.4. News	193
3.5. Manufacturing Locations, Capabilities, and Certifications (of electronic materials & related plants)	194

3.6. JVs and Partnerships	195
3.7. Sales Reps and Distributors by Region	195
3.8. TECHCET Analyst Assessment	196
3.9. Reference	196
4. Cryoin Engineering (Purifier/ Suppliers)	196
4.1. Cryoin Engineering-Company Overview	196
4.2. Business Segments	197
4.3. Financial Overview	197
4.4. News	197
4.5. Key Customers	198
4.6. Manufacturing Locations, Capabilities, and Accreditations	198
4.7. JVs and Partnerships	199
4.8. Sales Reps and Distributors by Region	199
4.9. TECHCET Analyst Assessment	199
4.10. Reference	199
5. DuPont (Maker, Purifier, Supplier)	200
5.1. DuPont-Company Overview	200
5.2. Business Segments	201
5.3. Financial Overview	202
5.4. News	202
5.5. Key Customers	202
5.6. Manufacturing Locations, Capabilities, and Accreditations	203
5.7. JVs and Partnerships	203
5.8. Sales Reps and Distributors by Region	204
5.9. TECHCET Analyst Assessment	204
5.10. Reference	205
6. Electronic Fluorocarbons (Purifier, Supplier)	205
6.1. Electronic Fluorocarbons-Company Overview	205
6.2. Business Segments	206
6.3. Financial Overview	206
6.4. News	207

6.5. Key Customers	207
6.6. Manufacturing Locations, Capabilities, and Accreditations	207
6.7. JVs and Partnerships	207
6.8. Sales Reps and Distributors by Region	207
6.9. TECHCET Analyst Assessment	207
6.10. Reference	208
7. Gas Innovations (Maker)	208
7.1. Gas Innovations-Company Overview	208
7.2. Business Segments	208
7.3. Financial Overview	209
7.4. News	209
7.5. Key Customers	209
7.6. Manufacturing Locations, Capabilities, and Accreditations	209
7.7. JVs and Partnerships	210
7.8. Sales Reps and Distributors by Region	210
7.9. TECHCET Analyst Assessment	210
7.10. Reference	210
8. Hangzhou Fortune (Maker, Purifier, Supplier)	211
8.1. Hangzhou Fortune-Company Overview	211
8.2. Business Segments	211
8.3. Financial Overview	212
8.4. News	212
8.5. Key Customers	212
8.6. Manufacturing Locations, Capabilities, and Accreditations	212
8.7. JVs and Partnerships	212
8.8. Sales Reps and Distributors by Region	213
8.9. TECHCET Analyst Assessment	213
8.10. Reference	213
9. Hyosung Corporation (Maker)	213
9.1. Hyosung Corporation-Company Overview	213
9.2. Business Segments	214

9.3. Financial Overview	214
9.4. News	215
9.5. Key Customers	215
9.6. Manufacturing Locations, Capabilities, and Accreditations	215
9.7. JVs and Partnerships	216
9.8. Sales Reps and Distributors by Region	216
9.9. TECHCET Analyst Assessment	216
9.10. Reference	217
10. Kaimeite (Maker, Purifier, Supplier).....	217
10.1. Hunan Kaimeite Gases-Company Overview.....	217
10.2. Business Segments	218
10.3. Financial Overview	218
10.4. News	218
10.5. Key Customers	219
10.6. Manufacturing Locations, Capabilities, and Accreditations	219
10.7. JVs and Partnerships	220
10.8. Sales Reps and Distributors by Region.....	220
10.9. TECHCET Analyst Assessment	221
10.10. Reference.....	221
11. Kanto Denka Kogyo(Maker, Purifier, Supplier)	221
11.1. Kanto Denka Kogyo-Company Overview	221
11.2. Business Segments	222
11.3. Financial Overview	223
11.4. News	223
11.5. Key Customers	224
11.6. Manufacturing Locations, Capabilities, and Accreditations	224
11.7. JVs and Partnerships	224
11.8. Sales Reps and Distributors by Region.....	225
11.9. TECHCET Analyst Assessment	225
11.10. Reference.....	225
12. Linde (Maker, Purifier, Supplier)	225

12.1. Linde-Company Overview.....	225
12.2. Business Segments	226
12.3. Financial Overview	227
12.4. News	228
12.5. Key Customers	228
12.6. Manufacturing Locations, Capabilities, and Accreditations	228
12.7. JVs and Partnerships	229
12.8. Sales Reps and Distributors by Region.....	230
12.9. TECHCET Analyst Assessment	230
12.10. Reference.....	230
13. Praxair (now a wholly owned subsidiary of Linde).....	231
13.1. Praxair-Company Overview	231
14. Linggas Limited (Purifier, Supplier).....	231
14.1. Linggas-Company Overview.....	231
14.2. Business Segments	231
14.3. Financial Overview	231
14.4. News	232
14.5. Key Customers	232
14.6. Manufacturing Locations, Capabilities, and Accreditations	232
14.7. JVs and Partnerships	233
14.8. Sales Reps and Distributors by Region.....	233
14.9. TECHCET Analyst Assessment	234
14.10. Reference.....	234
15. Niacet (Maker, Purifier)	234
15.1. Niacet Corporation-Company Overview	234
15.2. Business Segments	234
15.3. Financial Overview	235
15.4. News	235
15.5. Key Customers	235
15.6. Manufacturing Locations, Capabilities, and Accreditations	235
15.7. JVs and Partnerships	236

15.8. Sales Reps and Distributors by Region.....	236
15.9. TECHCET Analyst Assessment	236
15.10. Reference.....	236
16. Messer Group (Gases for life)-	236
16.1. Company Overview	236
16.2. Business Segments	237
16.3. Financial Overview	239
16.4. News	239
16.5. Key Customers	240
16.6. Manufacturing Locations, Capabilities, and Accreditations	240
16.7. JVs and Partnerships	240
16.8. Sales Reps and Distributors by Region.....	241
16.9. TECHCET Analyst Assessment	241
16.10. Reference.....	241
17. Numat (Maker).....	242
17.1. NuMat Technologies-Company Overview.....	242
17.2. Business Segments	242
17.3. Financial Overview	243
17.4. News	243
17.5. Key Customers	243
17.6. Manufacturing Locations, Capabilities, and Accreditations	244
17.7. JVs and Partnerships	244
17.8. Sales Reps and Distributors by Region.....	244
17.9. TECHCET Analyst Assessment	245
17.10. Reference.....	245
18. Peric-718, The 17th Institute of China Ship Building Industry Company (CSIC) (Maker, Purifier, Supplier)	245
18.1. Peric-718-Company Overview.....	245
18.2. Business Segments	245
18.3. Financial Overview	246
18.4. News	246

18.5. Key Customers	246
18.6. Manufacturing Locations, Capabilities, and Accreditations	247
18.7. JVs and Partnerships	249
18.8. Sales Reps and Distributors by Region.....	249
18.9. TECHCET Analyst Assessment	249
18.10. Reference.....	249
19. Showa Denko K.K. (Maker, Purifier, Supplier)	250
19.1. Showa Denko-Company Overview	250
19.2. Business Segments	250
19.3. Financial Overview	251
19.4. News	252
19.5. Key Customers	252
19.6. Manufacturing Locations, Capabilities, and Accreditations	252
19.7. JVs and Partnerships	253
19.8. Sales Reps and Distributors by Region.....	254
19.9. TECHCET Analyst Assessment	254
19.10. Reference.....	254
20. SK Materials (Maker, Purifier, Supplier)	254
20.1. SK materials Co.-Company Overview	254
20.2. Business Segments	255
20.3. Financial Overview	255
20.4. News	256
20.5. Key Customers	256
20.6. Manufacturing Locations, Capabilities, and Accreditations	256
20.7. JVs and Partnerships	257
20.8. Sales Reps and Distributors by Region.....	257
20.9. TECHCET Analyst Assessment	258
20.10. Reference.....	258
21. Spec Gas International Holdings (SGIH) / Europe-China Electric Materials Co., Ltd	
(ECEM) – (Maker)	258
21.1. Europe-China Electronic Materials (ECEM)-Company Overview	258

21.2. Business Segments	259
21.3. Financial Overview	259
21.4. News	259
21.5. Key Customers	259
21.6. Manufacturing Locations, Capabilities, and Accreditations	259
21.7. JVs and Partnerships	260
21.8. Sales Reps and Distributors by Region.....	260
21.9. TECHCET Analyst Assessment	260
21.10. Reference.....	261
22. Sumitomo Seika Chemicals Co., Ltd. (Maker, Purifier)	261
22.1. Sumitomo Seika Chemicals-Company Overview	261
22.2. Business Segments	262
22.3. Financial Overview	263
22.4. News	263
22.5.....	264
22.6. Key Customers	264
22.7. Manufacturing Locations, Capabilities, and Accreditations	264
22.8. JVs and Partnerships	265
22.9. Sales Reps and Distributors by Region.....	265
22.10. TECHCET Analyst Assessment.....	266
22.11. Reference.....	266
23. Taiyo Nippon Sanso Corp. (TNSC)/Matheson Gases (Maker, Purifier, Supplier)	266
23.1. TAIYO NIPPON SANSO-Company Overview	266
23.2. Business Segments	266
23.3. Financial Overview	267
23.4. News	267
23.5. Key Customers	268
23.6. Manufacturing Locations, Capabilities, and Accreditations	269
23.7. JVs and Partnerships	270
23.8. Sales Reps and Distributors by Region.....	270
23.9. TECHCET Analyst Assessment	271
23.10. Reference.....	272

24.	Versum Materials/Merck (Maker, Purifier, Supplier)	272
24.1.	Versum Materials/Merck-Company Overview	272
24.2.	Business Segments	273
24.3.	Financial Overview	273
24.4.	News	274
24.5.	Key Customers	274
24.6.	Manufacturing Locations, Capabilities, and Accreditations	274
24.7.	JVs and Partnerships	275
24.8.	Sales Reps and Distributors by Region	275
24.9.	TEHCET Analyst Assessment	276
24.10.	Reference	276
25.	Wonik Materials Co. Ltd.	276
25.1.	Wonik Materials-Company Overview	276
25.2.	Business Segments	277
25.3.	Financial Overview	279
25.4.	News	279
25.5.	Key Customers	280
25.6.	Manufacturing Locations, Capabilities, and Accreditations	280
25.7.	JVs and Partnerships	281
25.8.	Sales Reps and Distributors by Region	281
25.9.	TEHCET Analyst Assessment	281
25.10.	Reference	282
26.	Yingde Gases	282
26.1.	Company Overview	282
26.2.	Business Segments	282
26.3.	Financial Overview	283
26.4.	News	283
26.5.	Key Customers	283
26.6.	Manufacturing Locations, Capabilities, and Accreditations	284
26.7.	JVs and Partnerships	284
26.8.	TEHCET Analyst Assessment	285
26.9.	Reference	285

2 SCOPE, PURPOSE AND METHODOLOGY

2.1

SCOPE

This report covers the electronic gas materials market and supply-chain for these materials used in semiconductor device fabrication. The report contains data and analysis from TECHCET's data base and Sr. Analyst experience, as well as that developed from primary and secondary market research. For more information on TECHCET Critical materials Reports™ please go to <https://TEHCET.com>

One of the challenges that the gas companies encounter is profitability due to the timing of investments and industry downturns for large installations like Air Separation Units (ASUs) and Semiconductor fabs. In the meantime, new suppliers are emerging in the China market to support the “Made in China” program backed by the government. When these suppliers gain in capability and capacity, their influence could dramatically impact the gas supply chain in the next 3+ years.

2.2

PURPOSE

This Critical Materials Report™ (CMR) provides focused information for supply-chain managers, process integration and R&D directors, as well as business development managers, and financial analysts. The report covers information about key suppliers, issues/trends in the material supply chain, estimates on supplier market share, and forecast for the material segments.

2.3

METHODOLOGY

TEHCET employs subject matter experts having first-hand experience within the industries which they analyze. Most of TEHCET'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 TEHCET's proprietary, quantitative wafer forecast results in a viable long-term market forecast for a variety of process materials.

2.4

OVERVIEW OF OTHER TECHCET CMR™ REPORTS

TEHCET 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 below:

2019 - 2020 TECHCET REPORTS
1. CMP Consumables (Slurry, Pads, Disks)
2. ALD/CVD Precursors (Metals & Dielectrics)
3. Equipment Components- Quartz
4. Equipment Components- Silicon, SiC, Ceramics
5. Gases- Electronic Specialty, Bulk, & Rare
6. Rare Earth Market
7. Photoresist, Ancillary, & Extensions
8. Silicon Wafers
9. Sputter Targets
10. Metal Chemicals
11. Wet Chemical
12. Roadmaps & Device Technology