

Table of Contents

1. Report Scope	8
2. Report Highlights	8
3. Market Overview	9
3.1 Key Factors Influencing the Semiconductor Industry & CMP	9
3.2 Techcet Wafer Forecasting Model:	13
3.3 450mm Conversion	15
4. CMP Slurries.....	16
4.1 Executive Summary: CMP Slurry Market	16
4.2 Slurry Business Environment	17
4.3 Slurry Business Dynamics by Slurry Type.....	24
4.3.1 ILD Slurry	24
4.3.2 Selective STI (S-STI) Slurry	24
4.3.3 Tungsten Slurry	25
4.3.4 Copper & Barrier Slurry	26
4.3.5 TSV Slurry	28
4.3.6 Metal Gate (HkMG) Slurry	29
4.3.7 Polysilicon Slurry	30
4.4 3D Structures Process Considerations	31
4.5 Emerging Applications.....	33
4.6 Abrasive Supplier Business Environment	34
4.7 Supply Chain Issues Reality Check	34
4.8 CMP Slurry IP	35
4.9 CMP-Slurry Market Assessment & Outlook.....	35
4.9.1 CMP-Slurry Pricing Trends	36
4.9.2 CMP Slurry and Asia	36
4.9.3 3-5 Year Outlook	37
4.10 CMP Abrasive and Slurry Suppliers Profiles.....	37
4.10.1 Ace Nanochem Co, Ltd.....	41
4.10.2 Adcon Lab, Inc.	41
4.10.3 Air Products and Chemicals – now Versum Materials.....	41
4.10.4 Anji Microelectronics Co., Ltd.....	42
4.10.5 Asahi Glass Company, Ltd.	42
4.10.6 Baikowski.....	43
4.10.7 BASF SE	43
4.10.8 Cabot Corporation	44
4.10.9 Cabot Microelectronics Corporation	44
4.10.10 Cheil Industries Inc.	46
4.10.11 Dongjin SemiChem Company, Ltd.	46
4.10.12 Dow Electronic Materials	46
4.10.13 Eka Chemical	48
4.10.14 Elkem AS	48

TEHCET 2016 CMP Critical Materials Report

4.10.15	Eminess Technologies, Inc.	48
4.10.16	Evonik Industries AG	48
4.10.17	Ferro Corporation	49
4.10.18	FujiFilm Planar Solutions, LLC	50
4.10.19	Fujimi Incorporated	51
4.10.20	Fuso Chemical Company, Ltd.	53
4.10.21	W.R. Grace & Company	53
4.10.22	General Engineering and Research	53
4.10.23	Hitachi Chemical Co., Ltd.	55
4.10.24	Innovative Organics	56
4.10.25	Intersurface Dynamics	56
4.10.26	JGC Catalysts & Chemicals	56
4.10.27	JSR Micro, Inc.	57
4.10.28	KC Tech Company, Ltd.	57
4.10.29	Kemesys (acquired by Technic Inc.)	58
4.10.30	Merck KGaA/EMD	58
4.10.31	Mitsui Mining & Smelting Company, Ltd.	58
4.10.32	Nalco (An Ecolab Company)	58
4.10.33	NanoPhase Technologies Corporation	59
4.10.34	Nissan Chemical Industries, Ltd.	59
4.10.35	Nitta Haas Incorporated	59
4.10.36	Precision Colloids, LLC	60
4.10.37	Rhodia SA (Solvay SA)	60
4.10.38	Showa Denko KK	60
4.10.39	Silbond Corporation	60
4.10.40	St-Gobain SA	61
4.10.41	Soulbrain Co. Ltd. (formerly Techno Semichem Company, Ltd.)	61
4.10.42	UK Abrasives, Inc.	62
4.10.43	Universal Photonics, Incorporated	62
4.10.44	UWiZ Technology Co., Ltd.	62
4.10.45	Wacker Chemie AG	62
4.11	Mergers and Acquisitions	63
5.	CMP Pad Suppliers	65
5.1	Executive Summary Pad Market - 2016	65
5.2	The CMP Pad Market	65
5.3	Pad Design	72
5.4.	Pad Patents	73
5.5.	Subpads	74
5.6.	CMP-Pad Market Assessment & Outlook	75
5.7.	Supply Chain Challenges	75
5.8.	Pricing Trends	75
5.9.	CMP Pad Suppliers Chart	77
5.10.	CMP Pad Suppliers	78
5.10.1	3M	78

5.10.2	Cabot Microelectronics Corporation	78
5.10.3	Dow Electronic Materials.....	79
5.10.4	Eminess Technologies Inc.....	82
5.10.5	Fujibo Holdings, Inc.	82
5.10.6	innoPad, Inc. (acquired by private Korean firm, possibly NexGenCo)	83
5.10.7	IV Technologies Co., Ltd.....	83
5.10.8	JSR Micro, Inc.....	83
5.10.9	KPX Chemical Co., Ltd.....	84
5.10.10	NexPlanar Corporation/Cabot Microelectronic Corporation	84
5.10.11	Nihon Micro Coating Company, Ltd.	85
5.10.12	Nitta-Haas Incorporated	85
5.10.13	Planar Labs Corp.	85
5.10.14	Rogers Corporation	86
5.10.15	Sekisui Voltek	86
5.10.16	Spartan Felt Company.....	86
5.10.17	Thomas West Incorporated	86
5.10.18	Toray Industries, Inc.	87
5.10.19	Toho Engineering Co., Ltd.....	87
5.10.20	Toyo Tire & Rubber Co., Ltd. (exiting business)	88
5.10.21	Toyobo Company, Ltd.....	88
5.10.22	Others.....	88
7.	REFERENCES for the Reader:	90

List of Figures

Figure 3.1:	Global Semiconductor Market: source WSTS	9
Figure 3.2:	Increasing Impact of Materials Innovation on Chip Performance (Source: Semico Research)	10
Figure 3.3:	Number for CMP steps per Advanced Node (Source is Sematech Surface and cleaning Conference April 2015)	11
Figure 3.4:	Internet of Things Units Installed Base by Category (Millions of Units)	12
Figure 3.5:	Internet of Things Endpoint Spending by Category (Billions of Dollars)	12
Figure 3.6:	TEHCET 2016 Annual Wafer Starts (200mm equivalents).....	14
Figure 3.7:	2016 CMP Wafer Passes per Year.....	14
Figure 4.1:	2016 TAM for Slurry and Abrasive Suppliers	17
Figure 4.2:	Slurry Revenue Forecast by Application	18
Figure 4.3:	Slurry Volume at Point of Use.....	19
Figure 4.4:	Overall CMP Slurry Usage Market	20
Figure 4.5:	CMP Slurry Market Shares Overall	22
Figure 4.6:	Slurry Revenue Market Shares by Process – 2016&2020.....	23
Figure 4.7:	CMP Slurry Market Share ILD	24
Figure 4.8:	CMP Slurry Market Share – S-STI	25
Figure 4.9:	CMP Slurry Market Share – Tungsten.....	26
Figure 4.10:	CMP Slurry Market Share – Copper	27

Figure 4.11: CMP Slurry Market Share – Copper Barrier 28
Figure 4.12: MEMS CMP Cross Section 30
Figure 4.13.: FinFET vs. Planar Transistor..... 31
Figure 4.14: IMEC SRAM Cells..... 32
Figure 4.15: Sub 14nm CMP Processes..... 33
Figure 4.16: GE&R Nano-Contact Release Capsules (nano-CRC) for CMP Slurries..... 54
Figure 5.1: CMP Pad Revenue by Process Type 2014 -2020 66
Figure 5.2: 2016 CMP Pad Market Shares 67
Figure 5.3: Pad Revenue by Wafer Size - all process 68
Figure 5.4: Pad Revenue for 300mm by Process Type 69
Figure 5.5: Pad Revenue for 200mm Process Type..... 70
Figure 5.6: Pad Usage (Number of Pads) Forecast by Process Type71

List of Tables

TABLE 4.1: CMP ABRASIVE SUPPLIERS..... 38
TABLE 4.2: CMP SLURRY SUPPLIERS 39
TABLE 5.1: CMP ABRASIVE AND SLURRY SUPPLIERS- 201677