



Tantalum Capacitors

World Markets, Technologies &
Opportunities: 2016-2020

ISBN # 1-893211-11-8 (2016)

Tantalum Capacitors:

World Markets, Technologies & Opportunities: 2016-2020



Paumanok Publications, Inc.
502 Ballad Creek Court
Cary NC 27519
(919) 468-0384 Main Office
(919) 468-0386 Fax
info@paumanokgroup.com
www.paumanokgroup.com

©1988-2016 Paumanok Publications, Inc., includes the Industrial Market Research Division for Capacitors, Resistors, Inductors and Circuit Protection Devices; The Mergers & Acquisitions Due Diligence Division; The Single Client Consulting Division; The On-Site Presentation/Seminar and Events Division; The Monthly Report (MLCC, Chip Resistor and Tantalum Capacitor Supply Chain Monitoring); The Specialty Markets (Defense, Medical, Mining and Automotive Power); and 75% Ownership of Passive Component Industry Magazine.

Contact: Dennis M. Zogbi, President

ISBN # 1-893211-11-8 (2016)

Pages: 155

Price: \$3750.00 USD

Published: January 2016



Paumanok Publications
Industrial Strength Market Research

Tantalum Capacitors: World Markets, Technologies & Opportunities: 2016-2020

**TANTALUM CAPACITORS:
WORLD MARKETS, TECHNOLOGIES & OPPORTUNITIES:
2016-2020**

Copyright ©2016 Paumanok Publications, Inc.
Published by: Paumanok Publications, Inc.
Publication Date: January 2016
Pages:
\$3,750.00 USD
For General Consumption

Paumanok Publications, Inc.
502 Ballad Creek Court
Cary NC, 27519 USA
www.paumanokgroup.com
Customer Service: (919) 468-0384
info@paumanokgroup.com
ISBN # 1-893211-11-8 (2016)

It is our mission to empower manufacturers, distributors, OEM, EMS, financial institutions and governments with unbiased market research to protect their assets, build their wealth and prosper in goods times and bad.



All rights reserved. Permission to reprint materials is expressly prohibited without the prior written consent of Paumanok Publications, Inc.. The accuracy of the data used is deemed reliable but not guaranteed. There is no assurance that past performance will be repeated in the future.



Paumanok Publications
Industrial Strength Market Research

Tantalum Capacitors: World Markets, Technologies & Opportunities: 2016-2020

Tantalum Capacitors: World Markets, Technologies & Forecasts: 2016-2020

Table of Contents:

1.0 KEY FINDINGS:	12
Tantalum Capacitor Orientation:.....	12
The Electrolytic Sub-Set:.....	12
Tantalum Capacitors As a Sub-Set of The Global Capacitor Industry:	12
Value Proposition of Tantalum Capacitors To The Design Engineer:	13
Tantalum: Alternative Technologies:	13
Tantalum and The High Capacitance Premium Component Markets:.....	13
Tantalum Supply Chain and Risk Factors:	13
Tantalum Cost of Ownership:.....	14
Tantalum Capacitors: 25 Year Market Cycle:	14
Continued Impact of Dodd-Frank On The Global Tantalum Market	14
Tantalum Design-In (Notebooks, Desktops and Servers): Trends.....	14
Tantalum Legislation Confusing Customers:.....	15
Price Erosion In The Tantalum Capacitor Industry:	15
Anti-Collusion Lawsuits:.....	16
Tantalum Capacitors In Automobiles: 2015-2020:.....	16
Strategy Suggestions For Tantalum Capacitor and Related Materials Vendors: 2015-2020.....	16
Vertical Integration of The Supply Chain: What This Means For Other Capacitor Vendors:	16
Gas Infusion Process Versus Dipping Methods for Conductive Polymers:	17
Value-Added and Application Specific Markets for Tantalum Capacitors:.....	17
Closed Loop System Changes The Supply Chain:.....	17
A Closer Look At Recent Consolidation In The Tantalum Capacitor Industry:.....	18
2.0 TANTALUM CAPACITORS: TECHNOLOGY OVERVIEW:	19
Tantalum Capacitor Component Configurations:.....	19
Molded Chip:.....	21



Coated Chip:	22
Radial Dipped:.....	22
Molded Radial:.....	22
Molded Axial:.....	22
Hermetically Sealed:	22
Wet Slug Tantalum:.....	23
New and Emerging Tantalum Capacitor Component Configurations:.....	23
Tantalum Capacitors: Polymer Vs. Manganese Cathode Systems	23
Historical Development of Conductive Polymer Cathodes In Tantalum Capacitors:.....	23
Why Lower The ESR In Tantalum Capacitors?.....	24
Conductive Polymers In Use With Tantalum Capacitors:.....	24
Difference in Conductive Polymer Performance In The Finished Capacitor:	25
What Process Is Most Effective at Lowering The ESR in Tantalum Anodes:	25
Tantalum Capacitor Production Processing Differentiation:	26
Market Leaders In Conductive Polymer Tantalum Capacitors:.....	26
Market Potential and Growth in Conductive Polymer Capacitors:	26
3.0 TANTALUM CAPACITORS: GLOBAL VALUE, VOLUME AND PRICING:	27
Tantalum Capacitors: Changing Markets FY 2015	27
Tantalum Capacitors: Global Unit Shipments and Forecasts To 2020.....	29
Tantalum Capacitors: Global Value Shipments and Forecasts To 2020.....	31
Tantalum Capacitors: Global Average Unit Selling Pricing and Forecasts To 2020:	33
4.0 TANTALUM CAPACITORS: MARKETS BY TYPE:	34
Tantalum Capacitor Market Subsets: Demand By Configuration: FY 2015:	35
Molded & Coated Chip Tantalum Capacitor Markets: FY 2015	35
Molded Axial and Radial Leaded Tantalum Capacitor Markets: FY 2015.....	35
Radial Dipped Tantalum Capacitor Markets: FY 2015	35
Metal Case and Wet Slug (Axial, Unusual Case Sizes) Markets; FY 2015	35
Competition in Tantalum Capacitors by Type and Point of Differentiation:	37
Global Consumption Value for Tantalum Capacitors By Cathode System (Manganese Versus Conductive Polymer): FY 2015	39
5.0 TANTALUM CAPACITORS: END-USE MARKETS:	41
Projected Production VOLUME for Key END-PRODUCTS Consuming Capacitors, Resistors and Inductors (Top 18 End-Products) To 2020:.....	41
Introduction To Tantalum Capacitor Consumption By End-Use Market Segment:.....	43
Tantalum Capacitor Content Per Black Box: FY 2015:	43
Tantalum Capacitor Unit Consumption By End-Use Market Segment: FY 2015:	45
Tantalum Capacitor Unit Consumption By End-Use Segment and Key Product Market: FY 2015:.....	47
Computers: Market Forecast For Tantalum Capacitors; FY 2015-2020:	48



Wireless Handset Markets Forecast For Tantalum Capacitors; FY 2015-2020:..... 49

Consumer Audio and Video Imaging: Market Forecast For Tantalum Capacitors; FY 2015-2020: 49

Automotive: Market Forecast For Tantalum Capacitors; FY 2015-2020: 50

Telecommunications Infrastructure: Market Forecast For Tantalum Capacitors; FY 2015-2020:..... 50

Industrial, Defense, Medical, Aerospace and Downhole Pump: Market Forecast For Tantalum Capacitors; FY 2015-2020:..... 50

Tantalum Capacitor Consumption Value by End-Use Market Segment: FY 2015:..... 52

Computer Markets: Dollar Value Outlook for Tantalum Capacitors: 2015-2020..... 54

Telecommunications Infrastructure: Dollar Value Outlook for Tantalum Capacitors..... 54

Automotive : Dollar Value Outlook for Tantalum Capacitors: FY 2015 54

Defense and Aerospace : Dollar Value Outlook for Tantalum Capacitors: FY 2015 55

Consumer Audio and Video Imaging : Dollar Value Outlook for Tantalum Capacitors: FY 2015 55

Wireless Handset : Dollar Value Outlook for Tantalum Capacitors: FY 2015 56

Medical Electronics : Dollar Value Outlook for Tantalum Capacitors: FY 2015:..... 56

Oil & Gas and Other Markets for Tantalum Capacitors: FY 2015: 56

Tantalum Capacitors: Global Markets By Cathode System (Manganese Versus Polymer): FY 2015: 57

Tantalum Capacitors: Market Drivers and Challenges: FY 2016 58

6.0 TANTALUM CAPACITORS: MARKETS BY WORLD REGIONS: 60

Global Consumption Value for Tantalum Capacitors By World Region: FY 2015% 60

Asia Pacific Region: Tantalum Capacitor Market Demand: FY 2015:..... 60

The Chinese Market For Tantalum Capacitors: FY 2015: 60

The Japanese Market For Tantalum Capacitors: FY 2015:..... 61

The Korean Market For Tantalum Capacitors: FY 2015:..... 61

Other Important Markets in Asia For Tantalum Capacitors: FY 2015: 62

The Americas Region: Tantalum Capacitor Market Demand: FY 2015:..... 62

The USA Market For Tantalum Capacitors: FY 2015: 62

The Mexican Market For Tantalum Capacitors: FY 2015: 62

Other American Markets For Tantalum Capacitors: FY 2015:..... 63

The European Region: Tantalum Capacitor Market Demand: FY 2015:..... 63

The German Market For Tantalum Capacitors: FY 2015: 63

Other European Markets For Tantalum Capacitors: FY 2015: 63

7.0 TANTALUM CAPACITORS: GLOBAL DISTRIBUTION CHANNELS: 65

Introduction to Distribution Channels for Tantalum Capacitors: 65

Global Tantalum Capacitor Consumption Value By Channels of Distribution: FY 2015:..... 65

Electronic Component Distributors: FY 2015 Sales of Tantalum Capacitors Through Distribution: 65

Original Equipment Manufacturers: FY 2015 Sales of Tantalum Capacitors To OEM Customers: 65

Electronic Manufacturing Services Companies: FY 2015 Sales of Tantalum Capacitors To OEM Customers:..... 65

Major Tantalum Capacitor Customers By Channel Of Distribution: FY 2015 67



Top Global Distributors of Tantalum Capacitors: FY 2015:	67
Top OEM Companies Buying Tantalum Capacitors: FY 2015:	67
Top EMS Companies Buying Tantalum Capacitors: FY 2015:	67
Top Tantalum Capacitor Distributors & Their Approved Vendors: FY 2015:	69
Forecasted Changes in How Tantalum Capacitors Reach The End-Customer: FY 2015-2020:	70
8.0 TANTALUM CAPACITORS: WORLDWIDE COMPETITION:	71
Recent Consolidation Among Vendors In The Tantalum Capacitor Industry:	71
KEMET Purchases TOKIN Corporation From NEC:.....	71
AVX Purchases Nichicon’s Tantalum Operations:.....	72
Holystone International Acquires The Hitachi AIC Tantalum Line:.....	72
Vishay Acquires The Hitachi AIC Tantalum Line from HS Polytech:.....	72
GAM’s Acquisition of Cabot Supermetals:.....	72
KEMET Vertically Integrates With Niotan: What This Means For The Supply Chain (Blue Powder):.....	73
Global Competitive Environment For Tantalum Capacitors By Component Type and Configuration: FY 2015:.....	73
Global Competitive Environment For Tantalum Capacitors- Product Differentiation by Vendor: FY 2015:.....	74
Market Leaders in Tantalum Capacitor Differentiation:	76
125 Degree C (Automotive UTH):.....	76
Low Profile Tantalum Capacitors:.....	76
Low ESR Tantalum Capacitors:.....	76
Multi-Anode Tantalum Capacitors:.....	77
High Temperature Tantalum Capacitors: 150 to 230 Degrees C:.....	77
Fused Tantalum Capacitors:	77
Tantalum Capacitors for Hi-Reliability and Defense Applications:	77
Tantalum Capacitor Vendors: FY 2015 Global Sales and Market Shares:.....	78
KEMET Corporation:.....	80
AVX Corporation:.....	80
NEC Corporation/Tokin Electronics:.....	80
Vishay Intertechnology:.....	80
Sanyo Electronics (Panasonic):.....	81
Rohm Company Limited:.....	81
Samsung Electro-Mechanics Company:.....	81
Matsuo Electric:.....	81
Greatbatch, Inc.:.....	81
Firadec, Inc.:.....	82
9.0 TANTALUM CAPACITORS: COSTS TO PRODUCE:	82
Tantalum Capacitors: Costs To Produce: FY 2015:.....	82
Changes In The Costs To Produce Tantalum Capacitors: FY 2015:.....	82



Variable Cost Structure For Tantalum Capacitors: FY 2015: 83
 Variable Raw Material Costs: Tantalum Capacitors: FY 2015: 83
 Fixed Costs For Tantalum Capacitors FY 2015: 83
 Variable Overhead Charges for Tantalum Capacitors: FY 2015: 84
 Variable Labor Costs For Tantalum Capacitors: FY 2015: 84
 Other Variable Manufacturing Charges for Tantalum Capacitors: FY 2015: 84
 Tantalum Capacitors: Cost of Raw Materials By Type: FY 2015 86
 Tantalum Metal Powder and Wire: FY 2015: 86
 Leadframes: FY 2015: 86
 Silver Materials: FY 2015: 86
 Cathode Materials: FY 2015: 86
 Epoxy Resin: FY 2015: 87
 Other Materials: FY 2015: 87
 Tantalum Capacitors: Costs To Produce By Type: FY 2015: 89
 MN02 Cathode Type: FY 2015: 89
 Conductive Polymer Cathode Type: FY 2015: 89
 Specialty Tantalum Capacitors: Axial, Radial and Wet Slug: FY 2015: 89
 Tantalum Value Chain To The Capacitor Industry: FY 2015: 92
 Tantalum Alternatives In Electronics: FY 2015: 94

10.0 THE TANTALUM SUPPLY CHAIN: 96

Introduction To Tantalum Raw Materials: 96
 Tantalum: The Five Main Applications: 96
 Primary Sources of Tantalum Ores & Concentrates: 97
 Major Shift in Global Tantalite Supply in 2015 99
 Global Supply of Tantalum Ores & Concentrates: Trends & Directions (Primary Versus Secondary Sourcing Trends): 100
 Tantalum Inventories: FY 2015: 101
 Tantalum Concentrate Output by Mining Operation & Estimated Price Per Pound: 2015: 103
 Tantalum Ore Resource Updates: FY 2015 104
 AMG-CIF (Mibra): 104
 EMRD (Kenticha): 104
 Cabot (Tanco): 104
 Central Africa- DRC (Congo); REDEMI (Rwanda): 104
 Global Advanced Metals (Wodgina): 105
 Noventa (Mozambique): 105
 Mekios (Nigerian Cooperative) 105
 China Mining Operations: 105
 Russian Mining Operations: 105
 Artisanal Mining Operations: 106



“Closed Loop” Tantalite System in Africa Changes Supply Chain Dynamics:.....	106
Tantalum As a By-Product of Tin and Lithium Mining:.....	107
Recycled Tantalum (Urban Mining Update):	107
Tantalum Inventories and a New Direction at the DLA:	108
Tantalum Ore Pricing: Historical Annual Pricing: 1995-2016:	108
Tantalite Processing Into Tantalum Powder and Wire:	111
Engineered Tantalum Demand By End-Use Market Segment: FY 2015:.....	111
Tantalum Materials Usage in Electronics: FY 2015:.....	113
Capacitor Grade Tantalum Metal Powder & Wire: 2015:	113
Semiconductor Sputtering Targets:.....	113
Tantalum In Other Electronic Components:	114
Important Supply Chain Developments:	114
GAM’s Acquisition of Cabot Supermetals:.....	114
Kemet Vertically Integrates With Niotan:	115
Engineered Tantalum Material Consumption Value By End-Use Market Segment: FY 2015:.....	117
Capacitor Grade Tantalum Metal Powder, Wire and Cathode Material Consumption By Case Size (In Milligrams): 2015	119
Capacitor Grade Tantalum Powder and Wire Vendors: FY 2015 Market Shares:.....	121
KEMET (Blue Powder Corp.):.....	122
Ningxia Oriental Tantalum	123
H.C. Starck GmbH & Co KG.....	123
Global Advanced Metals (Showa-Cabot Supermetals):.....	123
NAC Kazatomprom:	124
F&X Electro-Materials Limited:	124
Duoluoshan SRM Co:	124
Plansee Austria.....	124
Metalysis UK	124
11.0 TECHNOLOGY TRENDS & DIRECTIONS:.....	125
Increasing The Capacitance Value of Tantalum Capacitors:.....	125
Engineered Tantalum Powders: Trends and Directions	125
Anode Powder Trends and Forecasts To 2020 :	127
Capacitor End-Use Market Segments That Drive The Tantalum Raw Material Markets	128
12.0 TANTALUM CAPACITORS: GLOBAL MARKET FORECASTS:.....	130
Tantalum Capacitors: Market Forecasting: FY 2015-2020	130
Tantalum Capacitors: Global Unit Shipment Forecasts: FY 2015-2020:.....	130
Tantalum Capacitors: Global Value Forecasts: FY 2015-2020:	132
Tantalum Capacitors: Global Pricing Forecasts: FY 2015-2020:	134
Tantalum Capacitors: Forecasts By End-Use Market Segment: FY 2015-2020:	136



Tantalum Capacitors: Forecasts By Channel of Distribution: FY 2015-2020:	138
Tantalum Capacitors: Forecasts By Cathode System (Polymer Versus Manganese): FY 2015-2020:	140
Tantalum Capacitors: Forecasts By World Region: FY 2015-2020:	141
Tantalum Metal Consumption in Capacitors (Anode Powder and Wire): Forecasts to 2020:.....	142
13.0 TANTALUM RESOURCE DIRECTORY	143
AMG CIF- BRAZIL (TANTALUM POWDER FOR SUPER METALS)	143
AVX CORPORATION (TANTALUM CAPACITOR MANUFACTURER).....	143
CABOT TANCO-TANTALUM MINING CORP. OF CANADA LTD. (TANTALUM MINING)	144
COMPANHIA INDUSTRIAL FLUMINENSE (TANTALUM MINING).....	144
CONGHUA TANTALUM & NIOBIUM SMELTERY (TANTALUM POWDER, INGOT & CHEMICALS).....	144
DUOLUOSHAN SAPPHIRE RARE METAL CO. (TANTALUM POWDER)	145
ETHIOPIAN MINERAL DEVELOPMENT SHARE COMPANY (TANTALUM MINING).....	145
F&X ELECTRO-MATERIALS LTD (TANTALUM POWDER).....	146
FIRADEC SA- EXXELIA (TANTALUM CAPACITOR MANUFACTURER).....	146
GAM GLOBAL ADVANCED METALS (TANTALUM MINING AND PROCESSING)	146
GREATBATCH, INC. (TANTALUM CAPACITOR MANUFACTURER)	147
H. C. STARCK GMBH & Co. KG (TANTALUM POWDER & WIRE)	147
KEMET CORPORATION (TANTALUM CAPACITOR MANUFACTURER).....	147
MATSUO ELECTRIC COMPANY LIMITED (TANTALUM CAPACITOR MANUFACTURER).....	148
METALYSIS LTD. (TANTALUM METAL POWDER).....	149
MINERAÇÃO TABOCA S.A. (TANTALUM MINING FOR FENbTA ALLOY).....	149
NAC KAZATOMPROM (CAPACITOR-GRADE TANTALUM POWDER, METAL POWDER AND WIRE).....	150
NEC CORPORATION/TOKIN (TANTALUM CAPACITOR MANUFACTURER)	150
NINGXIA ORIENT GROUP, CNMC NINGXIA NONFERROUS METALS (CAPACITOR TANTALUM POWDER & WIRE).....	151
NIOTAN, INC. (CAPACITOR GRADE TANTALUM POWDER) (NOW OWNED BY KEMET).....	151
PLANSEE (TANTALUM WIRE).....	151
REDEMI (TANTALUM MINERS).....	152
ROHM COMPANY LIMITED (TANTALUM CAPACITORS).....	152
SANYO ELECTRIC (PANASONIC) (TANTALUM CAPACITOR MANUFACTURER).....	152
SAMSUNG ELECTRO MECHANICS COMPANY LTD. (TANTALUM CAPACITOR MANUFACTURER)	153
TAIKE TECHNOLOGY (SUZHOU) Co LTD (FORMERLY KING METALLURGICAL) (TANTALUM POWDER AND INGOT).....	153
TANTALITE RESOURCES (TANTALUM MINING)	153



ULBA METALLURGICAL PLANT (TANTALUM POWDERS, INGOT AND MILL PRODUCTS)..... 153
 VISHAY INTERTECHNOLOGY, INC. (TANTALUM CAPACITOR MANUFACTURER)..... 154

List of Figures:

Figure 1: Tantalum Capacitors By Component Configuration: FY 2015 20
 Figure 2: Global Capacitor Markets by Dielectric (Type): FY 2015..... 28
 Figure 3: Global Unit Shipments for Tantalum Capacitors: 2003-2015; 2016-2020 Forecasts 30
 Figure 4: Global Value of Shipments for Tantalum Capacitors: 2003-2015; 2016-2020 Forecasts 32
 Figure 5: Global Average Unit Selling Prices for Tantalum Capacitors: 2003-2015; 2016-2020 Forecasts 33
 Figure 6: Variations on Tantalum Capacitor Technology: An Important Point of Technical Granularity 34
 Figure 7: Global Consumption Value for Tantalum Capacitors by Configuration: FY 2015 36
 Figure 8: Competitive Environment in Tantalum Capacitors By Component Configuration: FY 2015 38
 Figure 9: Tantalum Capacitor Demand By Cathode System: FY 2015 40
 Figure 10: Projected Production VOLUME for Key END-PRODUCTS Consuming Capacitors, Resistors and Inductors (Top 18 End-Products) To 2020 42
 Figure 11: Average Content of Tantalum Capacitors per "Black Box" 44
 Figure 12: Global Consumption Volume for Tantalum Capacitors By End-Use Market Segment: FY 2015 (In Millions of Pieces)..... 46
 Figure 13: Global Consumption Volume for Tantalum Capacitors By End-Use Market Segment and End-Use Product Market: FY 2015 (In Millions of Pieces) 47
 Figure 14: Global Consumption Volume Forecasts for Tantalum Capacitors By End-Use Market Segment: FY 2015 to FY 2020 (In Millions of Pieces) 51
 Figure 15: Tantalum Capacitor Consumption Value By End-Use Market Segment: FY 2015 Source: Paumanok Publications, Inc. Estimates 53
 Figure 16: Tantalum Capacitor Demand By Cathode System: FY 2015..... 57
 Figure 16: Tantalum Capacitors: Market Drivers and Challenges 59
 Figure 18: Global Consumption Value For Tantalum Capacitors By World Region: FY 2015 (In Millions of USD)..... 64
 Figure 19: Global Value of Consumption For Tantalum Capacitors By Channel of Distribution: FY 2015..... 66
 Figure 20: Major Tantalum Capacitor Customers By Channel of Distribution: FY 2015..... 68
 Figure 21: Top Electronic Component Distributors and Their Respective Tantalum Capacitor Vendors; FY 2015 69
 Figure 22: Global Competitive Environment For Tantalum Capacitors By Component Type and Configuration: FY 2015..... 74
 Figure 23: Global Competitive Environment For Tantalum Capacitors- Product Differentiation by Vendor: FY 2015..... 75
 Figure 23: Vendor Consolidation in the Tantalum Capacitor Supply Chain From 2013 to 2015..... 79
 Figure 26: Tantalum Capacitor Cost To Produce Comparison: FY 2015 (With Comparison To 2013 and 2010)..... 83
 Figure 27: Fixed and Variable Cost Structure For The Production of Tantalum Capacitors: FY 2015..... 85
 Figure 28: Raw Materials Breakdown For The Production of Tantalum Capacitors FY 2015 88
 Figure 29: Average Cost of Goods Sold For Tantalum Capacitors By Type (Manganese, Polymer and Specialty): FY 2015..... 90
 Figure 28: Tantalum Capacitors: Costs To Produce Summary Chart: FY 2015..... 91



Figure 30: Tantalum Value Chain To The Worldwide Capacitor Industry: 2015 93

Figure 30: Alternatives To Tantalum in Electronics: FY 2015..... 95

Figure 31: Global Supply of Tantalum Ores & Concentrates: Trends & Directions (Primary Versus Secondary Sourcing Trends)..... 102

Figure 32: Global Value of Consumption for Tantalum Ores & Concentrates: Pricing 103

Figure 34: Tantalum Ore Pricing: Historical Annual Pricing: 1995-2016..... 109

Figure 34: Tantalum Ore Pricing Trends By Month April 2012-January 2016 110

Figure 33: Global Demand for Engineered Tantalum Metal By End-Use Market Segment: FY 2015 112

Figure 34: Global Demand for Engineered Tantalum Metal By Application In The Electronics Industry: FY 2015 116

Figure 35: Engineered Tantalum Material Consumption By End-Use Market Segment: FY 2015 118

Figure 39: Capacitor Grade Tantalum Metal Powder and Wire Content by Molded Chip Case Size: FY 2015 119

Figure 40: Tantalum Powder Consumption By Case Size (In Milligrams)..... 120

Figure 36: Capacitor Grade Tantalum Powder and Wire Vendors: FY 2015 Market Shares 122

Figure 40: Trends In Tantalum Capacitor Capacitance Value Per Gram of Material in Selected Case Size: FY 2015 126

Figure 41: Trends In anode powder Market by Capacitance Value Per Gram of Tantalum Powder: Nanotechnology Improvements over Time 127

Figure 42: End-Use Markets That Drive Demand For Tantalum Materials Over Time 129

Figure 43: Tantalum Capacitor Global Unit Forecasts: FY 2016-FY 2020 131

Figure 44: Tantalum Capacitor Global Dollar Value Forecasts: FY 2016-FY 2020..... 133

Figure 45: Tantalum Capacitor Global Pricing Forecasts: FY 2016-FY 2020 135

Figure 46: Tantalum Capacitor Consumption Value Forecasts By End-Use Market Segment: FY 2015 137

Figure 47: Tantalum Capacitors: Forecasts By Channel of Distribution: 2015-2020 139

Figure 48: Tantalum Capacitors: Forecasts By Cathode System: 2015-2020 140

Figure 49: Tantalum Capacitors: Forecasts By World Region: 2015-2020..... 141

Figure 50: Tantalum Metal Consumption in Capacitor Anode (Powder & Wire): FY 2016-2020 Forecast 142

