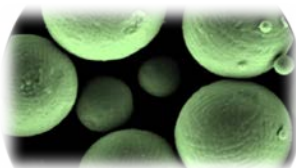




TITANIUM

ORES AND POWDERS FOR MLCC

World Markets in MLCC Ceramic Dielectrics
(Connecting Blockchain Node 8108)



Paumanok Publications, Inc. has established provenance in the 8532 HTS Code. Paumanok digital assets have been used for utility of mapping the supply chain in capacitors, resistors and inductors. This report is important because it documents a key Periodic Table Material known as Titanium, which is further mixed into barium titanate- the key ceramic dielectric material for all MLCC.



Table of Contents-

HOW CERAMIC DIELECTRIC MATERIALS ARE USED:	7
TECHNICAL ECONOMICS OF CERAMIC DIELECTRIC MATERIALS:	23
<i>Scientific Maxim #1: Capacitance & Surface Area:</i>	23
<i>Why Ceramic Capacitors Are So Economical:</i>	23
TITANIUM: INTRODUCTION TO 30 YEARS OF PAUMANOK RESEARCH IN CERAMICS	23
INTRODUCTION TO CERAMIC DIELECTRIC MATERIALS:	23
<i>How Ceramic Dielectric Materials Are Used:</i>	24
THE TECHNICAL ECONOMICS OF CERAMIC DIELECTRIC MATERIALS:	24
<i>Capacitance and Surface Area:</i>	24
IMPORTANCE OF RAW MATERIALS:	25
<i>Technical Manipulation of Dielectric Materials:</i>	25
VERTICAL INTEGRATION OF CERAMIC DIELECTRIC MATERIALS INTO COMPONENTS:	25
<i>MLCC Dielectrics By Component Type (PGM Versus BME Matching Systems)</i>	25
CERAMIC DIELECTRIC MATERIALS: REPORT OVERVIEW:	26
<i>Focus of This Specific Report</i>	26
RESEARCH METHODOLOGY EMPLOYED:	27
<i>The Paumanok Process:</i>	27
THE PAUMANOK RESEARCH METHODOLOGY: 30 YEARS STUDYING MLCC AND CERAMIC DIELECTRIC MATERIAL MARKETS	28
<i>Government Data Collection and Resources:</i>	29
<i>Secondary Published Sources:</i>	29
<i>Primary Intelligence Gathering:</i>	29
CAPACITORS AND THE GLOBAL VALUE OF THE MLCC SUB-CATEGORY	30
<i>Fixed Capacitor Markets and The Value of Their Respective Sub-Categories: FY 2020</i>	30
THE MLCC SUPPLY CHAIN:	31
<i>MLCC: Mining of Raw Dielectric Materials and Conductive Metals:</i>	32
<i>MLCC Raw Materials Processing:</i>	32
<i>MLCC Capacitor Manufacturing:</i>	32



<i>MLCC Capacitor Distribution:</i>	33
<i>MLCC End-Market Consumption:</i>	33
<i>MLCC Technology Differentiation:</i>	35
<i>MLCC Regional Markets And Key Consuming Countries:</i>	35
<i>MLCC Recycling of Critical Materials:</i>	35
THE TECHNICAL ECONOMIC MAXIMS ASSOCIATED WITH MLCC:	36
<i>The Two Technical Economic Maxims Associated with MLCC (MLCC Available Surface Area and Engineered Materials):</i>	36
<i>Ubiquitous Nature of MLCC In Electrical and Electronic Circuits:</i>	37
<i>Relationship Between Performance and Available Surface Area in MLCC:</i>	37
<i>The Growth of Ceramic Dielectric Materials Markets:</i>	37
<i>Why MLCC Manufacturers Source The Merchant Market for Ceramic Dielectric Materials:</i>	37
Feedstock Sourcing:.....	38
Barium Titanate Sourcing:	38
Additive Sourcing:	38
Formulation Sourcing:	38
<i>Why MLCC Manufacturers Vertically Integrate Ceramic Dielectric Material Production:</i>	38
<i>Titanium Dioxide Processing:</i>	39
TITANIUM DIOXIDE MARKET SIZE:	40
<i>Titanium Dioxide Market Shares:</i>	40
<i>High Purity Titanium Dioxide Markets In Electronic Components:</i>	42
<i>Merchant versus Captive Supply of High Purity Titanium Dioxide:</i>	42
<i>High Purity Titanium Dioxide Suppliers To The Electronic Component Industry:</i>	43
CERAMIC DIELECTRIC MATERIALS: WORLD MARKETS: 2021-2025	44
<i>Barium Titanate: World Markets, Technologies, & Opportunities: 2021-2025</i>	44
INDUSTRY SNAPSHOT: UNDERSTANDING THE SUPPLY CHAIN FOR BARIUM TITANATE TO MLCC	45
<i>Supply Chain Map Of The MLCC Ceramic Dielectric Materials Industry: This Describes the Chart On The Prior Page</i>	45
Dielectric Material Mining:.....	46
Dielectric Material Processing:	46
Dielectric Materials Formulation:	46
GLOBAL MARKET VOLUME FOR BARIUM TITANATE: AND HISTORICAL GROWTH BY YEAR	48
<i>Global Market Volume For MLCC Ceramic Dielectric Materials: 2020 and Historical Growth (In Millions of USD):</i>	48
<i>Global Market Value For MLCC Ceramic Dielectric Materials: 2020 and Historical Growth (In Millions of USD):</i>	50
<i>Average Price Per Ton For MLCC Ceramic Dielectric Materials: Ten Year Historical Growth (Global Consumption in USD as Indicated)</i>	51



GLOBAL CONSUMPTION VALUE FOR MLCC BARIUM TITANATE BY PRODUCTION PROCESS	54
<i>Global Barium Titanate Consumption Value By Type: 2020 (Oxalate, Hydrothermal, BCZT, Solid State and Sol-Gel)</i>	<i>54</i>
THE GLOBAL MARKET FOR MLCC CHEMICAL OXALATE MATERIALS.....	56
THE GLOBAL MARKET FOR MLCC SOLID STATE CERAMIC DIELECTRIC MATERIALS	56
THE GLOBAL MARKET FOR MLCC HYDROTHERMAL CERAMIC DIELECTRIC MATERIALS	57
THE GLOBAL MARKET FOR MLCC BCZT CERAMIC DIELECTRIC MATERIALS	58
THE GLOBAL MARKET FOR MLCC SOL-GEL CERAMIC DIELECTRIC MATERIALS	58
GLOBAL AVERAGE PRICE PER POUND FOR MLCC BARIUM TITANATE BY PRODUCTION PROCESS:	58
MANUFACTURERS OF BARIUM TITANATE BY PRODUCTION PROCESS: GLOBAL MARKET SHARES	59
MATERIAL TECHNOLOGY	62
FUTURE FOCUS OF MLCC CERAMIC DIELECTRIC MATERIALS TECHNOLOGY IMPROVEMENTS:.....	62
<i>Technology in MLCC Advanced Ceramic Dielectric Materials:.....</i>	<i>62</i>
MLCC THIN CERAMIC DIELECTRIC LAYER TECHNOLOGY	63
<i>The Need For Thinner MLCC is Driving Demand:.....</i>	<i>63</i>
<i>The 220 Microfarad and 330 Microfarad MLCC Development:.....</i>	<i>63</i>
<i>The 470 Microfarad MLCC Development:.....</i>	<i>64</i>
<i>The 1,000 Microfarad MLCC Development:.....</i>	<i>64</i>
<i>Technology Development Correlation With Thin MLCC Ceramic Layers:.....</i>	<i>64</i>
<i>Dielectric Layer Thicknesses Achieved by Various Process Methods for MLCC Grade Barium Titanate:</i>	<i>64</i>
<i>MLCC Dielectric Layer Thicknesses for Ceramic Dielectric Materials:</i>	<i>66</i>
<i>Future Focus of MLCC Barium Titanate Technology Improvements:</i>	<i>67</i>
<i>Improving The Purity of MLCC Dielectric Precursors:.....</i>	<i>67</i>
<i>Improving Fired MLCC Dielectric Thickness Capabilities:</i>	<i>67</i>
<i>Improving MLCC Dielectric Particle Size Shape and Consistency:</i>	<i>67</i>
<i>Reducing Agglomeration in BTO MLCC Powders (NanoOxalate Development):.....</i>	<i>67</i>
<i>Developments in Micro-emulsion Synthesis of Barium Titanate:.....</i>	<i>68</i>
<i>Improving Powder Dispersion In Slurry:</i>	<i>68</i>
<i>Improving Electrode Matching & Leach Prevention:.....</i>	<i>68</i>
<i>Improving Tape Yield Ratios:</i>	<i>69</i>
FORECASTS: GLOBAL MARKET FORECASTS FOR BARIUM TITANATE: 2021-2025	70
<i>Forecast: Global VOLUME of MLCC Ceramic Dielectric Material Consumption: FY 2021-2025</i>	<i>70</i>
<i>Key Economic Data Supporting MLCC Barium Titanate Volume Forecasts to 2025.....</i>	<i>70</i>
<i>Forecast: Global VALUE of MLCC Ceramic Dielectric Material Consumption: FY 2021-2025.....</i>	<i>71</i>



Titanium Ores and Powders for MLCC Market Insights

Forecast: Global Average PRICE Per Ton for MLCC Ceramics: FY 2021-2025:	72
CERAMIC DIELECTRIC FORMULATIONS VENDORS GLOBAL SALES AND MARKET SHARES	75
Ceramic Dielectric Formulation Suppliers To The Global Merchant Market: FY 2020 Estimated Market Shares Worldwide	75
FORECASTS: GLOBAL OUTLOOK FOR CERAMIC DIELECTRIC MATERIALS: FIVE YEAR OUTLOOK	77
Forecast: Global Value of Consumption Forecasts for Ceramic Dielectric Materials Consumed in MLCC	77
MLCC- COSTS TO PRODUCE	78
MLCC- VARIABLE AND FIXED COST DEEP DIVE ANALYSIS	78
Breakdown of Cost of Goods Sold For MLCC: FY 2020	78
Raw Material Costs Associated With MLCC: FY 2020	78
Fixed Costs Associated With The Production of MLCC: FY 2020	79
Variable Overhead Costs Associated With The Production of MLCC: FY 2020	79
Variable Labor Costs Associated With The Production of MLCC: FY 2020	80
Variable Manufacturing Costs Associated With The Production of MLCC: FY 2020	80
Raw Materials Consumed in the Production of MLCC: Cost Breakdown: FY 2020	80
MLCC: RAW MATERIALS BREAKDOWN:	82
Ceramic Dielectric Material Markets: 2020	82
Electrode Materials:	83
Termination Materials:	83
Assembly Materials:	84
Packaging Materials:	84
MLCC FORECASTS: 2022-2027	86
Ceramic, 0201 MLCC (Chips (0201 BaTiO ₂):	86
Ceramic, 0402 MLCC (Chips (0402 BaTiO ₂):	86
Ceramic, 0603 MLCC (Chips (0603 BaTiO ₂):	86
Ceramic, 0805 MLCC (Chips (0805 BaTiO ₂):	86
Ceramic, 1206 MLCC (Chips (1206 BaTiO ₂):	86
Ceramic, 1210-1225 MLCC (Chips (1210-1225 BaTiO ₂):	87
Global Markets By Case Size: (EIA Case Sizes in Inches)	87
MLCC Consumption Volume by Case Size: 2022-2027 Estimates (EIA Case Sizes in Inches)	87
MLCC Consumption Value by Case Size: 2022-2027 Estimates (EIA Case Sizes in Inches)	88
MLCC Consumption Pricing ASP by Case Size: 2022-2027 (EIA Case Sizes in Inches)	89
DIRECTORY OF TITANIUM ORES & CONCENTRATES- MATERIAL VENDORS	91



BEMAX RESOURCES LIMITED (BEMAX) (TITANIUM FEEDSTOCK)	91
CHONGQING SOUTHERN CHEMICALS CO., LTD. (BARIUM CARBONATE, TITANIUM DIOXIDE, BARIUM TITANATE)	91
CRISTAL GLOBAL (TITANIUM FEEDSTOCK)	92
DUPONT TITANIUM TECHNOLOGIES (HIGH PURITY TITANIUM DIOXIDE)	92
FUJI TITANIUM INDUSTRY CO., LTD. (ISK GROUP SUBSIDIARY) (HIGH PURITY TITANIUM DIOXIDE, FORMULATIONS)	92
HIEU GIANG CO. LTD. (TITANIUM FEEDSTOCK)	93
JIARUN FINE CHEMICALS CO., LTD. (HIGH PURITY TITANIUM DIOXIDE, HIGH PURITY BARIUM CARBONATE, BARIUM TITANATE)	93
HANHUA SPECIALTY CHEMICALS (BARIUM TITANATE, BARIUM CARBONATE, TITANIUM DIOXIDE)	94
HUNSTMAN INTERNATIONAL LLC (HIGH PURITY TITANIUM DIOXIDE)	94
ILUKA RESOURCES (TITANIUM FEEDSTOCKS)	95
INDIAN RARE EARTHS LIMITED (IREL) (TITANIUM FEEDSTOCKS)	95
KENMARE RESOURCES PLC. (TITANIUM FEEDSTOCKS)	96
KRONOS WORLDWIDE, INC. (HIGH PURITY TITANIUM DIOXIDE)	96
PANGANG TITANIUM INDUSTRY COMPANY LIMITED (TITANIUM FEEDSTOCKS)	97
PROSPERITY DIELECTRICS (PDC/WALSIN) (BARIUM TITANATE, FORMULATIONS)	97
RICHARDS BAY MINERALS (RIO TINTO) (TITANIUM FEEDSTOCKS)	97
SAKAI CHEMICAL INDUSTRY COMPANY LIMITED (HIGH PURITY TITANIUM DIOXIDE, BARIUM CARBONATE, BARIUM TITANATE)	98
SHOWA TITANIUM CO., LTD. (SHOWA-DENKO KK) (HIGH PURITY TITANIUM DIOXIDE)	98
SUKGYUNG AT Co., LTD. (HIGH PURITY BARIUM CARBONATE, HIGH PURITY TITANIUM DIOXIDE, BARIUM TITANATE)	99
TIWEST PTY (TRONOX/EXXARO) (HIGH PURITY TITANIUM DIOXIDE)	99
TOHO TITANIUM COMPANY LIMITED (HIGH PURITY TITANIUM DIOXIDE)	99
TRONOX INCORPORATED (HIGH PURITY TITANIUM DIOXIDE)	100

Table of Figures-

Figure 1: Paumanok Research Methodology	28
Figure 2: Fixed Capacitor Market Breakdown by Sub-Category: FY 2020	30
Figure 3: The Passive Electronic Capacitor Supply Chain.....	31
Figure 4: The Technical Economic Maxims Associated With MLCC.....	36
Figure 3: Titanium Dioxide Suppliers:	40
Figure 4: Top Titanium Dioxide Vendors To The Global Market:	41
Figure 5: High Purity Titanium Dioxide Suppliers To The Electronic Component Industry:	43
Figure 6: Mining, Engineering and Composition Supply to The Merchant and Captive Markets	44
Figure 7: Supply Chain Map Of The Ceramic Dielectric Materials Industry: FY 2020	47
Figure 8: Global Market Volume For MLCC Ceramic Dielectric Materials: Historical Growth by Year (Global Consumption in Tons)	49



Titanium Ores and Powders for MLCC Market Insights

Figure 9: Global Market Value For Barium Titanate: Historical Growth by Year (Global Consumption in MM of USD).....	50
Figure 10: Average Price Per Ton For Ceramic Dielectric Materials: FY 2010-2020 Global Consumption Value in USD per Ton).....	53
Figure 11: Global Consumption Value for MLCC Ceramic Dielectric by Production Process (Oxalate, Solid State, HTBT, BCZT and Sol-Gel Processes).....	55
Figure 12: Global Average Price Per Pound for Barium Titanate By Production Process: FY 2020	59
Figure 13: MLCC Ceramic Dielectric Materials Suppliers To The Global Merchant Market: FY 2020 Estimated Market Shares Worldwide (Based Upon Revenues)	61
Figure 14: Correlation of MLCC Dielectric Layer Thickness Achieved by Various Process Methods for Barium Titanate (In Microns)	66
Figure 15: FORECAST: Global Volume of Barium Titanate Consumption: FY 2021-2025 (IN TONS).....	70
Figure 16: FORECAST: Global Value of Barium Titanate Consumption: FY 2021-2025 (In Millions of US Dollars).....	72
Figure 17: FORECAST: Global Price Per Ton For Barium Titanate: FY 2021-2025 (IN USD)	74
Figure 18: Ceramic Dielectric Formulation Suppliers To The Global Merchant Market: FY 2020 Estimated Market Shares.....	76
Figure 19: FORECAST: Global Value, Volume and Pricing Forecasts for Ceramic Dielectric Materials Consumed in MLCC: 2021-2025.....	77
Figure 20: Raw Materials Consumed in the Production of MLCC: Cost Breakdown (TOTAL COST OF GOODS SOLD) VARIABLE COSTS-	81
Figure 21 Raw Materials Consumed in the Production of Ceramic Capacitors: Cost Breakdown: FY 2020	85
Figure 24: MLCC Consumption Volume by Case Size: 2022-2027 Forecasts	87
Figure 25: MLCC Consumption Value by Case Size: 2022-2027 Forecasts	88
Figure 26: Global Consumption ASP Selling Price for MLCC by Case Size: 2022-2027 Forecasts (In Millions of USD).....	89

INTRODUCTION: This report identifies suppliers who are adding value to the electronic component supply chain through materials engineering, and establishes their market shares, operational locations, value, volume and pricing of materials, as well as Strengths, Weaknesses, Opportunities and Threats as it relates to the specific area of focus on the node of the blockchain.



Figure 1: Paumanok ISBN# 1-89-3211-38-X Research: 1988 to Present Day Description of The 8532 Capacitor Blockchain Project; Including Connections Between Components and Materials

22 TI TITANIUM 47.88	56 BA BARIUM 137.33	46 PD PALLADIUM 106.42	28 NI NICKEL 58.69	47 AG SILVER 107.87	29 CU Copper 63.55
Titanium Ores & Concentrates Transactions 8108 Element 22	Barium Ores & Concentrates Transactions 2511 Element 56	Palladium Ores & Concentrates Transactions 7110 Element 46	Nickel Ores & Concentrates Transactions 2604 Element 28	Silver Ores & Concentrates Transactions 2603 Element 47	Copper Ores & Concentrates Transactions 2603 Element 29
Processing Titanium Dioxide Powder 2823.00.0000	Processing Barium Carbonate Powder 2826.60.0000	Processing Palladium Powder 7110.21.0000	Processing Nickel Powder 7504.00.0010	Processing Silver Powder 7106.10.0000	Processing Copper Powder and Flake 7406
Barium Titanate Powder Solid State BT Chemical Process Alkoxide BT Hydrothermal BT SolGel BT Other Capacitor Grade Ceramic Materials					
Engineering Nanotechnology Capacitor Grade Ceramic Formulations Ceramic MLCC Formulations XTR Ceramic Ecosystem XSR Ceramic Ecosystem NPAC/CAC Ceramic Ecosystems		Engineering Nanotechnology Palladium MLCC Electrodes Low Fire Pd/Ag MLCC Electrode Material Markets High Fire Pd/Ag MLCC Electrode Material Markets	Engineering Nanotechnology Nickel MLCC Electrodes Other Pd Nickel MLCC Powder	Engineering Nanotechnology Silver Terminations Silver Powder Terminations Silver Paste Terminations	Engineering Nanotechnology Copper Terminations Copper Powder Terminations Copper Flake Terminations Copper Paste Terminations
Engineering Nanotechnology High Reliability Ceramic Dielectric Materials High Voltage Ceramic Dielectric Materials High Frequency Ceramic Dielectric Materials High Temperature Ceramic Dielectric Materials Rare Earth Additives Materials		8532 24 Ceramic Dielectric, Multilayer MLCC			
		MLCC: Form and Variable Costs of Production			
		MLCC Markets, Technologies & Opportunities High Cap RMF MLCC 01005 MLCC 02010 MLCC 0402 MLCC 0603 MLCC 0805 MLCC 1206 MLCC 1210 MLCC			
		General Purpose MLCC Markets High Reliability MLCC Transactions High Voltage MLCC High Temperature MLCC High Frequency MLCC			
		MLCC End Markets and Ecosystems MLCC For Wireless Handsets MLCC For Computers MLCC For Consumer Audio And Video Imaging MLCC For IOT and CANH Automotive MLCC For EVs Propulsion MLCC For Medical Test Equipment MLCC For Defense Electronics MLCC For Oil & Gas Electronics MLCC For Industrial and Infrastructure MLCC Forecasts and Insights			
		PAUMANOK 8532 BLOCKCHAIN PROJECT: CAPACITORS			

Source: Paumanok Blockchain Project 2022



Paumanok Provenance in the 8532 HTS-Trade and Transactions- CAPACITORS- All 300 Technical-Economic deep dive analysis (In PDF or NFT Minted Format) in the collection are written by Dennis M Zogbi and are considered digital assets covering granular relationships in the 8532 and 8533 Harmonized Tariff Schedule (Blockchain) for ubiquitous electronic components consumed in all electronic devices connected to the feedstock raw materials required for their manufacture. The founder has been a keynote speaker at multiple industrial conferences worldwide; a key member of electronic industry association and is the columnist for Berkshire Hathaway's TTI Marketeye for 25 years and an on-site advisor for technology hedge funds that use the founder's blockchain formulas to invest in equities, commodities and futures. The founder has engineered blockchains for mergers and acquisitions, new product development, disruptive technologies, new markets and new cultures. Repeat customers over the past 30 years include brand name OEM, EMS and Financial Institutions in the USA, Japan, China, Germany, France, UK, Israel, Italy, Belgium, Slovenia, Korea ROK, Singapore, Thailand, Philippines; Australia, Indonesia and Iceland.

Paumanok IMR Utility in Global Capacitor Trade and Blockchain Engineering as a Service: Paumanok Publications, Inc. Industrial Market Research has been in continuous business for 33+ years and has a global voice in the 8532 and 8533 sections of the International Harmonized Tariff Code and includes capacitors, resistors, magnetics and circuit protection; a blockchain representing trillions of pieces and tons of dielectrics, electrodes, anodes, cathodes and terminations that represent a significant number of transactions each year. The purpose of this project is to engineer roadmaps of transactions and establish links between keystone materials. Because of their utility as tools to profit from a blockchain based upon the 8532 and 8533 HTS Schedules (representing the largest volume products in units 4.4 trillion production starts expected for 2022- a supply chain that will benefit from blockchain over time).

Paumanok IMR Blockchain Roadmap in the HTS 8532 Global Trade: The project will make PDF's available and mint NFTs as digital assets and will be posted based upon links between chains in the 8532 and 8533 HTS codes. This will begin with MLCC (Ceramic Capacitors) and their support materials; followed by tantalum, aluminum, plastic, carbon; resistors, magnetics and circuit protection components. The collection will include Deep Dive Market Study Minted NFTs and Collectible Issues of Passive Component Industry Magazine.

Deep chains connect electronic materials to ores and feedstocks including bauxite, copper, nickel, palladium, silver, ruthenium, tantalum, barium, titanium, neodymium. Vertical chains link feedstocks, nanotechnology, engineered materials, matching materials, processing equipment and kilns, with kilns branching off into tunnel and batch type; as well as fired component bodies in case sizes established by the EIA in inches (and viewed overseas in millimeters). The passive components are ubiquitous components that are required and consumed in every electronic circuit, with clear paths to profitability

8532 Capacitor Global Community: The 8532 and 8533 HTS Codes contain a mapped out 300 manufacturers worldwide representing a community of 300,000 employees and \$60 Billion USD in Revenues; while the larger segment of "Microelectronics" trade and transaction which



Titanium Ores and Powders for MLCC Market Insights

includes active semiconductor and passive components represents \$700 Billion in worldwide electronic component production combined. This feeds into a myriad of component performance categories in general purpose, high voltage, high temperature and high frequency market segments, in the wireless handset, personal computer, automotive ICE, automotive EVx propulsion, consumer audio and video imaging and home theatre; defense, space, civil aviation, oil & gas, medical test equipment; medical implants, semiconductor manufacturing equipment, industrial power, infrastructure, networking, renewable energy systems and emerging technologies.

Related Paumanok 8532.2 MLCC Blockchain Reports

- Titanium in MLCC
- Barium in MLCC
- Palladium in MLCC
- Nickel in MLCC
- Silver in MLCC
- Titanium Dioxide in MLCC
- Barium Carbonate
- Barium Titanate
- Ceramic Dielectric Formulations
- MLCC Production Costs: Fixed and Variable
- MLCC Markets by Case Size
- MLCC Vendor Competitive Analysis, Factories by Country and Market Shares
- MLCC in Handsets
- MLCC in Computers
- MLCC in Auto ICE and CASE
- MLCC in Auto EVx Propulsion
- MLCC in Consumer Audio and Video Imaging
- MLCC in Industrial and Infrastructure
- MLCC in Defense Electronics
- MLCC in Medical Test Equipment
- MLCC in Space Electronics



Titanium Ores and Powders for MLCC Market Insights

- MLCC in Oil & Gas Electronics
- High Voltage MLCC Ecosystems
- High Temperature MLCC Ecosystems
- High Frequency MLCC Ecosystems

Prior Editions of This Report under Paumanok [ISBN# 1-89-3211-38-X \(2021\)](#)

©1995 ©2010 ©2005 ©2012 ©2015 ©2021

Paumanok Publications, Inc. has been at the forefront of market research in passive electronic components and related materials for decades. Paumanok is employing the fundamental codes of the harmonized tariff schedules (HTS) as a basis for new Blockchain Codes for the 8532 channel. New codes are necessary to adequately describe supply chains and connect them with the materials and feedstocks they require.

To See These and Other Reports in PDF Format-

www.paumanokgroup.com

About this report

This document addresses the global market for Multilayered Ceramic Chip Capacitors (hereafter referred to as MLCC)- their technologies and related feedstock and raw material supply chains.

When Science Meets Money



The critical scientific principal surrounding all Capacitor technology is that capacitance is equivalent to the physical size, or available surface area of the finished capacitor. This in turn makes the raw materials consumed in the production of Capacitors the most expensive portion of “Cost of Goods Sold,” and the area where the application of best practices can have the greatest impact on decreasing the cost of goods sold and increasing operating margins.

Focus of This Specific Report

MLCC- Multilayered ceramic chip capacitors; the workhorse of the passive electronic component industry. Paumanok estimates that 4.4 trillion MLCC were produced in 2021, of which about 1.7 trillion will be consumed and 2 trillion will be materials work-in-process, and 0.4 trillion will be defective or go into stockpiles at key OEM, EMS and Distribution companies.

This report focuses specifically on consumption value, volume and pricing for Titanium Ti- Element 22) consumed as a fundamental keystone material to make ceramic dielectric materials used in multilayered ceramic chip capacitors. The report uses provenance of the publisher to establish the connection between the HTS 8532 and 8108 codes for blockchain purposes. The relationship between titanium and capacitors has been well documented for 70 years in “mass-produced” ceramic capacitor technology. This report creates a blockchain pathway that establishes titanium as a keystone material for MLCC production worldwide.

Research Methodology Employed:

The methodology employed to do this study combines secondary and primary data sources, including government data; company financial data and primary human intelligence resources to draw conclusions. This is called a “legacy” of data that is designed to make sure that all pieces of the market “puzzle” fit together. Also we have the unique capability to benchmark the markets we study with previous studies under the same title produced in the past two decades. This enables us to establish the “Delphi -Method” which suggests that the trend of sales over time will support a similar rate of growth in the future. We caveat this approach by also employing “Box-Jenkins” methods of market research which adjust forecasts based upon our knowledge of current events and their impact. Remember, Paumanok provides a unique market view based upon input from multiple resources in the supply chain, including dielectric materials, ores and concentrate resources; electrodes, terminations; equipment, stacking, winding; firing/furnaces; drying, wire winding; pressed pill, porous anode, polymer cathode resources both primary and secondary that give us a unique perspective. Paumanok views finance and component distribution as separate markets that create “value-added” from the process of supply and demand. Government is involved as well in the form of regulations, especially environmental, ITAR, mining and conflict minerals. Capacitors may in fact be

