HIGH-TEMPERATURE MLCC

World Markets, Technologies, & Opportunities for Ceramic Capacitors and Dielectric Materials for 170C+ Operation: 2021-2026 Outlook

Research Analysis by
Dennis M. Zogbi
CEO and Founder
Paumanok Publications, Inc.
Cary, NC 27513 USA
(919) 468-0384
www.paumanokgroup.com
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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 will be produced in 2021, of which about 2 trillion will be consumed and 2 trillion will be work-in-process, and 0.4 trillion will be defective or go into stockpiles at key OEM, EMS and Distribution companies.

This report focuses on a very narrow area of the industry where profitability is 75% and where a specific degree of technical expertise is required to compete effectively in the space, but where the margins are the largest. Such businesses thrive in high cost manufacturing locations such as the USA, France and UK and involve very low volume, very labor intensive production using off-the-shelf ceramic formulations and precious metal electrodes and terminations; air fired in batch kilns specifically designed for low volume, high value component manufacturing where price is secondary to quality and reliability. These "mom and pop: operators have "known reliability" which is a powerful selling tool in the high temperature vertical markets in which they compete (Defense, Space, Oil & Gas, Geothermal).

The High-Temperature High Technology Ecosystem-

The temperature measurements that separate technology and differentiate the vendors who compete in the narrow, but highly profitable high-temperature space are shown in the chart below and are fragmented into management sectors- "Defense and Aerospace" but with emphasis upon only those products that can be subjected to high temperatures- Missile defense, space electronics, munitions and hypersonic aircraft. The other areas are in "Industrial Electronics" and involve oil & gas logging tools and sensors and geothermal measuring instruments.

Figure 1: Applications For High Temperature Capacitors >175 Degrees C

Degrees C	High Temperature Application
150-200	Oil & Gas Electronics Drlling Instruments/Logging Tools Permanent Sensors Downhole Electric Pumps
201-249	Oil & Gas Electronics Drlling Instruments/Logging Tools Permanent Sensors Downhole Electric Pumps Defense & Aerospace Electronics Aircraft Engine Electronics Power Generation Turbines
250-274	Industrial Electronics Geothermal Power Generation
275-300	Industrial Electronics Geothermal Power Generation Nuclear Power Systems Spacecraft and Satellites Rocket and Missile Systems Rocket Engine Electronics
300+	Aicraft Outer Skin Rocket Engines Space Station Electronics Satellites and Spacecraft

Source: Paumanok Publications, Inc.

High Temperature Defense & Aerospace Electronics EcoSystems-

Defense electronics applications requiring high temperature capacitors include the following electronic subassemblies:

- Satellites: Power Supply Systems for Communications and Weather Satellites
- Aircraft: Transmitter Power Supplies for Electronics Counter Measures (ECMs)
- Weapons: Detonator Devices For Exploding Foil Initiators Used In Electronics Safe & Arm Devices(ESADs)
- Sensors: Partial Discharge Sensing Equipment
- Unpackaged Bread-boarding Circuitry
- Radar: Pulse Forming Network Transmitters
- Aircraft: Starters for Jet Ignition Systems
- Aircraft: Multiple Power Supply Systems
- Missiles: Guidance System Transmitters for Missiles
- Ships: Radar Transmitters for Shipboard Defense Systems
- Radar: Travelling Wave Tube (TWT) Power Supplies for Radar Transmitters
- International Space Station: Multiple Requirements that Are Power Supply Related

THE READER SHOULD KNOW- In the proximity of jet engines, many electronic applications at extremely high temperatures take place (i.e. pressure and temperature sensors and thrust regulators for example). These applications are typically low voltage, and include coupling/decoupling, filtering, operational amplifiers and instrumentation-amplifier feedback circuits, line filters, and wave form shaping circuits that require capacitors to operate successfully.

In the capacitive discharge ignition (CDI) systems used to ignite jet engines, the operating temperature can reach 200 °C or more. High temperature capacitors also are used in conjunction with jet exhaust sensor systems, landing systems, fuel pumps and other aviation applications.