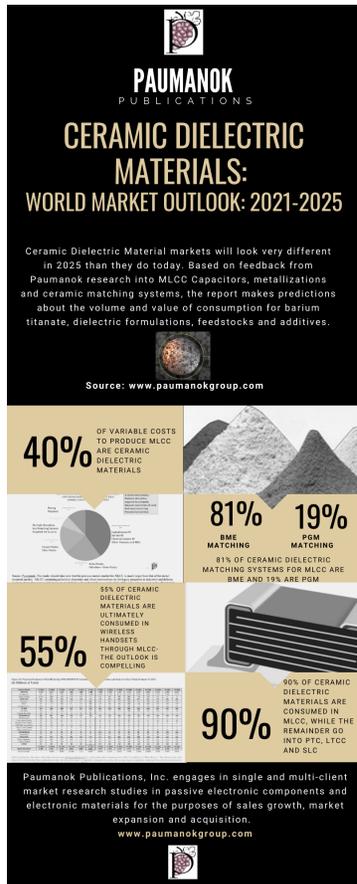


CERAMIC DIELECTRIC MATERIALS

World Markets, Technologies & Opportunities: 2021-2025 Outlook and Supply Chain Assessment



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SECTION ONE:

MLCC: INTRODUCTION TO 30 YEARS OF PAUMANOK RESEARCH IN CERAMICS

Introduction to Ceramic Dielectric Materials:

How Ceramic Dielectric Materials Are Used:

Ceramic dielectric materials are used primarily in ceramic capacitors, including multi-layered ceramic chip capacitors (MLCC), radial leaded ceramic capacitors, axial leaded ceramic capacitors and single layered disc ceramic capacitors. Additional ceramic dielectric material markets include ceramic PTC thermistors, high frequency ceramic filters and LTCC components and substrates.

The focus of this report is ceramic dielectric materials for ceramic capacitors; which account for 90% of global ceramic dielectric materials consumption in terms of dollar value, with the remainder in thermistor, filters and Low Temperature Co-Fired ceramic (LTCC) substrates.

Ceramic dielectric materials encompass the dielectric layer that forms capacitance in a ceramic chip capacitor. The dielectric layer is either stacked (MLCC), rolled (MLC Leaded), or pressed (Single layered Ceramic). Ceramic dielectric materials compete against tantalum dielectric materials, aluminum foils, and plastic films. Ceramic capacitors, specifically the MLCC have the lowest cost structure to produce, and the highest profit margins among all capacitors.

The Technical Economics Of Ceramic Dielectric Materials:

Capacitance and Surface Area:

One primary scientific maxim associated with electronics is that capacitance is equivalent to the physical size of the finished product or the total available surface area of the dielectric material. Ceramic capacitors accomplish this through stacking dielectric layers; tantalum

