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Fraunhofer Institute for Ceramic
Technologies and Systems IKTS

LTCC technologies

Reliable millimeter-wave
frequency applications

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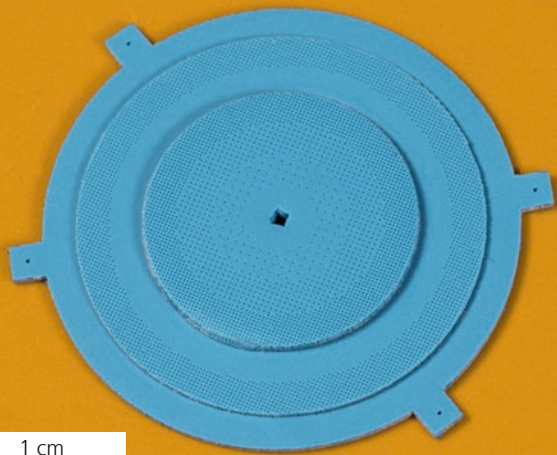
LTCC technologies for millimeter-wave frequency applications

Our approach is to establish LTCC materials as a basic packaging solution for millimeter-wave applications and antennas in order to develop reliable and miniaturized microelectronic high-frequency components.

LTCC (low-temperature co-fired ceramics) materials offer outstanding high-frequency characteristics such as a very low loss angle and a comparable low permittivity over a measured temperature range from -50°C to 150°C . Due to their glass-ceramic composition, they also offer a high degree of reliability, for example under harsh environmental conditions. With its multilayer-ability to become 3D-structured, it is possible to integrate electrical circuits or to realize ceramic packages. LTCC in combination with a new, high resolution structuring technology allow unique low loss characteristics above 100 GHz.

Further advantages of LTCC high-frequency boards or packagings are:

- High-temperature stability (300°C and more)
- Excellent thermo-mechanical adaption to semiconductor components
- Hermetical sealing of packages
- Stability in aggressive atmospheres
- Realization of hybrid components with integrated conducting, dielectric, magnetic, piezoelectric and sensorial materials



GRIN (gradient index) lens for 60 GHz open-ended waveguide antenna in LTCC-multilayer design.

LTCC materials used and well experienced at IKTS for HF applications and their most important material properties

LTCC material	Electrical/RF		Thermal	
	ϵ_r (10 GHz)	Tan δ (10 GHz)	CTE (ppm/K)	Thermal Cond. (W/mK)
Micromax 951	7.5	0.0054	5.8	3.3
Micromax 9k7	6.8	0.0012	4.4	4.6
Vibrantz A6M-E	5.6	0.0011	7.0	2.0

Services offered

- Development of multilayer ceramic high-frequency components according to customer-specific designs
- Selection and characterization of suitable materials
- Development and qualification of manufacturing processes
- Sample manufacturing in small or medium quantities, characterization and transfer of manufacturing technology

Fraunhofer IKTS

As a research and technology service provider, Fraunhofer IKTS develops modern high-performance ceramic materials, industry-relevant manufacturing processes and prototype components and systems in complete production lines up to pilot scale.

We are a specialist for multilayer-based functional ceramic materials, microcomponents and microsystems, covering the entire value chain. Fraunhofer IKTS has a wide range of tools for the design and layout of multilayer ceramic components and systems, as well as a complete technology line for the development and manufacture. Functional characterizations and reliability tests can also be carried out.

Cover: 30-dBi gain LTCC-based transmittarray with embedded anisotropic printed cells.

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