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THz spectroscopy of new materials for high frequency LTCC applications

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The rapid development of modern 5G and 6G communication systems is connected with a increasing demand for new dielectric substrate materials, which should provide higher signal transmission speed and miniaturization as well as possibility of passive component integration. Requirements for such new materials include a low dielectric constant to minimize signal propagation delay, low dielectric losses for frequency selectivity and reduced energy consumption, and a low sintering temperature to allow the use of multi-layer LTCC/ULTCC (low/ultra-high temperature ceramic fired). With the modification of materials with a low dielectric constant, such as: silica, borosilicate glasses, cordierite, mullite, forsterite, diopside, willemite, aluminates, which have been well known for decades, less popular ceramics have recently appeared, such as: as borates, tungstates, molybdates, vanadates, and phosphates. The use of ceramic-ceramic or glass–ceramic composites is an effective way to tailor microstructure, electric, and thermal properties of functional materials for microwave substrates.

In particular, this approach enables the production of layered structures with buried passive electronic components using advanced LTCC technology, which offers relatively low cost, flexibility in design and production, a high degree of miniaturization and integration. Here, we present terahertz time domain characterization of a few selected materials including their refractive indices and the absorption coefficients. This research was funded by NATIONAL SCIENCE CENTRE, Poland, grant number 2019/35/B/ST5/02674.

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