Microwave complex permittivity of highly anisotropic nematic liquid crystals for tunable components

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We report on measurements of the complex permittivity of highly anisotropic nematic liquid crystals at microwave frequencies as a function of the AC bias voltage. A split post dielectric resonator (SPDR) is used to determine the effect of AC bias voltage on the microwave complex permittivity of nematic liquid crystals. High resistivity silicon transducers separated by 100 μm are bridged by nematic liquid crystals and their properties determined [1,2]. The experiments have shown that when the AC bias voltage increases from 0 to 8 V, the real part of the permittivity of these liquid crystals changes by up to 28%. Using high resistivity silicon allowed us to obtain tunable dielectric stacks with relatively small dielectric losses at microwave frequencies. The tunability and the relatively low dielectric losses observed in these liquid crystal mixtures mean that they are ideal materials for the design of tunable microwave components [1,2]. It should also be noted that the effective dielectric losses of silicon decrease with increasing frequency, and thus these silicon-based cells containing the liquid crystals can be used in millimeter wave- and terahertz-tunable devices such as low-cost tunable phase shifters, varactors, and filters.

Acknowledgments:
This research was supported by the Polish Ministry of Sciences and Higher Education under Grant No. O R00 0144 12, entitled “Tunable liquid crystal transducers for THz and GHz frequency range” and partially by the National Science Center under Grant No. 2012/07/N/ST8/03284, entitled “New materials of metal–dielectric type based on quartz and noble metals at THz frequencies.” The authors would like to thank Professor R. Dąbrowski of MUT for providing the liquid crystal materials.

References:

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