Nanocomposites and nanomaterials

Electro-optical investigation of bulk and nanostructured materials with tailored anisotropy in subTHz frequency range

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Nanostructured materials represent a considerable interest both from a fundamental point of view as well as potential their applications. One of the ways to obtain nanostructure composites is embedding of relevant materials into porous matrices of the nanometer pore size. The filled nanoporous matrices can adjust the dimensions, spatial position and/or orientation of the confined particles using different mesh pore geometry. Accordingly, the nanocomposites based on the porous matrices may be filled by solid or liquid crystals materials as well as other substrates, see e.g. [1-3].

Their characteristics (*e.g.* the anisotropy [4]) are very important for many optical sensing applications [5]. Amazingly that host porous matrices with cylindrical tabular nanopores exhibit itself anisotropic properties behaving as optically uniaxial crystals [6]. If the pores of a nanoporous material are additionally filled with another anisotropic material, then the new nanostructured crystalline material with tailored anisotropy will acquire more clearly pronounced anisotropy and could reveal unique physical properties.

We have developed the technology [7] that can perform precision measurements of the bulk materials in subTHz range using vector network analyzer. By utilizing frequency extenders from Virginia Diodes allows us to extend the operating frequency range from 50 GHz to 500 GHz while keeping the same dynamic range about 100dB. In the cooperation with Dresden University of Technology it is planned to fabricate the nanostructured materials filled by $LiNbO_3$ [2] or other crystals in the pores. And it is also proposed to investigate electrooptical parameters of such bulk crystals and fabricated nanostructures in subTHz frequency range with aim of their possible practical application.

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