ELLIPSOMETRY AT THZ FREQUENCIES: NEW APPROACHES FOR METROLOGY AND METAMATERIAL-BASED SENSING

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The precise measurement of electromagnetic material properties at THz frequencies is essential for the development of increasingly advanced THz optical systems and a prerequisite for the design and manufacturing of optical elements for this spectral range. The exploration of novel physical phenomena observed in artificially structured metamaterials and the application thereof is of interest due to its relevance for the design and fabrication of novel THz optical elements and sensors. Metamaterials have attracted continued interest for almost two decades due to their unique electromagnetic properties, which can differ substantially from their constituents and often do not even exist in naturally occurring materials.

We have demonstrated that although being orders of magnitude smaller than the probing wavelength, metamaterials composed of highly-ordered 3-dimensional metal nanostructures exhibit a strong anisotropic optical response at THz frequencies. I will discuss how these interesting optical properties can be used for sensing of minute target material quantities in the THz spectral range. In addition, I will focus on a novel avenue for the fabrication of THz metamaterials using stereolithographic techniques. For the THz spectral range, where spatial resolutions in the range of several um are sufficient to create subwavelength metamaterial building blocks, stereolithography-based additive fabrication might offer a readily accessible approach which is so far unrealized. Here, metamaterials composed of spatially coherent methacrylates wires will be shown as an example. Our observations demonstrate that stereolithography may provide an alternative avenue to the fabrication of metamaterials for the terahertz spectral range and may allow tailoring of the polarizability and anisotropy of the host material by design.

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