AN ANTIREFLECTION COATING FOR A TERAHERTZ ISOLATOR

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Nonreciprocal radiation transmission is of great importance for the protection of sources or detectors from backscattering, and undesired radiation routing. Terahertz (THz) radiation finds its application in different systems for imaging, wireless communications, and sensing. However, the lack of THz nonreciprocal devices limits the performance of such THz systems. Recently, several approaches have been proposed for the realization of terahertz one-way transmission devices. Among them, traditional devices based on magneto-optical material [1,2] allow broadband isolation with moderate losses. The basis of such devices is a permanent magnet, which possesses a high dielectric constant and as a consequence high Fresnel reflection losses. To improve the isolator performance, it's necessary to reduce the reflection losses at the air-magnet interface. The most common way for the realization of antireflection coating is in the usage of a quarter-wave film deposition with a refractive index $n_{AR} = \sqrt{n}$. However, this approach is only applicable for narrowband reflection dampening and requires rare materials with a specific refractive index. Alternatively, subwavelength surface modification can be used for the damping of reflection losses over a broad frequency band. In our work, we present a THz isolator with reduced reflection losses in forward propagation and power transmission at least equal to 50% within the 0.1-0.3 THz. The anti-reflection coating has been fabricated in form of the subwavelength pyramid structure at the hexaferrite surface.

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DEVELOPMENT OF F-THETA LENS FOR THZ IMAGING SYSTEM

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The dispersion of complex permittivity in THz frequency range provides information on low-frequency molecular vibrations and structural properties of matter. This allows the use of modern methods of THz spectroscopy and imaging to solve a wide range of applied problems in the areas of research of physical properties of new materials [1], quality control of pharmaceutical and chemical products [2], nondestructive control of composite materials and ceramics [3] and even cancer diagnostics [4]. Terahertz (THz) imaging is of particular interest, where scanning a planar surface is the objective of the imaging system. Instead of spherical lenses, f-theta lenses can be used as focusing optics in such systems. Such lenses are designed to provide a linear displacement of the beam as a function of the deflection angle, resulting in a constant scan rate on a planar surface. F-theta lenses produce constant spot size and imaging resolution depending on the deflection angle, which eliminates distortion at the edges of the field of view [5]. Although f-θ lenses are widely used in other parts of the optical spectrum, their design and the effect of material properties on lens performance in the THz frequency range have not been widely studied.

In this paper, robust numerical method to design custom scanning f-theta lenses in the THz range will be presented. The optical performance of lenses designed using commonly used polymers for THz optics manufacturing will be compared, namely high-density polyethylene (HDPE), polytetrafluoroethylene (PTFE), polymethylpentene (TPX), cyclic olefin copolymer (COC), and cycloolefin polymer (COP).

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