61

High-efficient broadband THz absorber

Author(s): Prof. PAVELYEV, Vladimir[1]
Co-author(s): Mr. TUKMAKOV, Konstantin [1] ; Mr. RESHETNIKOV, Anton [1] ; Mr. TZIBIZOV, Ivan [2] ; Dr. KROPOTOV, Grigory [2]

[1] *Samara University*

[2] *Tydex LLC*

Corresponding Author(s): pavelyev10@mail.ru

Perfect THz absorption has attracted increasing research interest in recent years due to the potential applications in photo-detectors [1]. Here we present the high efficient broadband THz

absorber, which is a low-resistance silicon plate with a 3-level structure formed on one side. Since low-resistance silicon has a high absorption in the THz range, it was decided to use it as a THz absorber. To increase the amount of absorption, it is necessary to reduce losses associated with Fresnel reflection. Antireflection film coating of silicon surface [2] and antireflection silicon structuring [3] have been considered. To provide broadband absorption, a 3-level antireflective structure has been realized by use of reactive ion etching (Bosch process) used for fabrication of silicon terahertz diffractive optical elements in [2,4]. Two samples of an absorber from p-type ρ=0.54 Ohm•cm silicon wafers with a diameter of 50 mm and thickness of 500 μm were fabricated. To characterize the absorbing properties of the samples, transmittance/reflection measurement was performed by use of Menlo Systems Tera K8 THz spectrometer. The measured absorption was more than 95% in the range of 0.5-2.0 THz. It can be concluded that fabricated structures can be used as effective broadband absorbers of THz radiation and promising for sensitive elements in various THz radiation detectors. Similar structures could be used for reducing of reflection losses at the air-silicon interface of transmissive silicon optical elements of the THz range.

1. J. Lehman, A. Sanders, L. Hanssen, B. Wilthan, J. Zeng, C. Jensen, Very black infrared detector from vertically aligned carbon nanotubes and electric-field poling of lithium tantalite, Nano Letters, 10, 3, P. 3261 (2010).
2. A.N. Agafonov, B.O. Volodkin, A.K. Kaveev, B.A. Knyazev, G.I. Kropotov, V.S. Pavel'ev, V.A. Soifer, K.N. Tukmakov, E.V.Tsygankova, Yu.Yu. Choporova, Silicon diffractive optical elements for high-power monochromatic terahertz radiation, Optoelectronics, Instrumentation and Data Processing, 49, pp. 189-195 (2013)
3. C. Brückner, T. Käsebier, B. Pradarutti, S. Riehemann et al., Broadband antireflective structures applied to high resistive float zone silicon in the THz spectral range, Optics Express, 17, 5, P. 3064 (2009).
4. A.N. Agafonov, B.O. Volodkin, D.G. Kachalov, B.A. Knyazev, G.I. Kropotov, K.N. Tukmakov, V.S. Pavelyev, D.I. Tsypishka, Yu.Yu. Choporova, A.K. Kaveev, Focusing of Novosibirsk Free Electron Laser (NovoFEL) radiation into paraxial segment, Journal of Modern Optics, 63, 11,pp. 1051-1054 (2016)