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Compact solutions in room temperature operating Terahertz imaging systems

Gintaras Valusis
Center for Physical Sciences and Technology, Lithuania

Terahertz (THz) imaging is a powerful technique and can be widely used in materials testing, security applications, medical research, etc. Its direct implementation for practical aims provide an impetus to search compact solutions in room temperature operating emitters/detectors design as well as compact passive optical elements. In a given communication, we discussed several principles which can be applied to realise detection schemes and compact focusing optics in THz imaging systems based on solid state structures. Three types of room temperature operating THz sensors - bow-tie diodes, nanometric field effect transistors and titanium-based microbolometers will be examined, and their operation will be demonstrated and compared through multispectral THz imaging of various objects. Performance of multi-pixel detectors arrays will be considered via frequency range of operation, detectors' sensitivity and noise-equivalent power; special attention will be attributed to coupling antennas - both resonant and broadband - design. As an example of solid state-based compact optics solution, we demonstrate that combination of the zone plate and laser-ablated resonant filter in a single device allows one to concentrate incident THz radiation and enhance signal in order of magnitude. To illustrate the effect, two designs of zone plates were tested - the first one with regular open Fresnel's zones, while another one - with laser-ablated resonant filters in the positions corresponding to the open zones of the first plate. Experimental results are illustrated by numerical simulations based on three-dimensional finite-difference time-domain method. Options for further improvements will be discussed, implementation for real-time imaging applications will be considered.

Biography

Gintaras Valusis graduated from the Vilnius University, Physics Faculty, in 1985. In 1992, he got his PhD (Vilnius University). From 1995 - 1996 he did his Post-doc in Dresden University of Technology, Institute of Applied Photo Physics. In 2000, he was Alexander von Humboldt Fellow in J. W. Goethe University, Physics Institute (Frankfurt/M, Germany). Currently, he withholds positions of Director in the Center for Physical Science and Technology and Professor in Semiconductors Physics Department of Physics Faculty in the Vilnius University.

valusis@pfi.lt