Doped Lead Telluride-Based Alloys – a New Type of Sensitive Detectors of Terahertz Radiation

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Abstract— Doping of the lead telluride and related alloys with the group III impurities results in appearance of the unique physical features of a material, such as persistent photoresponse, enhanced responsive quantum efficiency (up to 100 photoelectrons/incident photon), high radiation hardness and many others. We present the physical principles of operation of the photodetecting devices based on the group III-doped IV-VI including the possibilities of a fast quenching of the persistent photoresponse, construction of the focal-plane array, and others. We report on the performance of lead telluride-based single direct detectors. The optical NEP as low as $6*10^{-20}$ W/Hz^{1/2} at T=1.57 K has been demonstrated at the wavelength of 350 µm. The advantages of terahertz photodetecting systems based on the group III-doped IV-VI are summarized.