InAs P-N Junction as a Surface Terahertz Emitter

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Surface THz emitters have practical advantages over Photoconductive antennas (PCAs) such as no need for external electric field and the ability to generate THz in a wider activation wavelength range. However, they still require high optical powers and are not feasible for industry.

It has been known for long that the bulk p-InAs is the best surface THz emitter. This is due to the fact that surface defects (density of $\sim 10^{12}$ cm$^{-2}$) create a static electric charge also known as the surface accumulation layer [1]. This surface accumulation layer, similarly to a P-N junction, induces a depletion region forming a built-in surface electric field [2], which, in turn, allows to strongly polarize the lattice explained by the EFOIR effect. Following this principle, an actual InAs P-N junction has been MBE grown (Fig. 1) and compared to bulk p-InAs. Favorably, the InAs P-N junction seems to be promising (Fig. 2).

Further investigations aim to add external electric field to increase the P-N depletion width and treat this structure as a diode-like THz emitter. Also, the cheap and compact telecommunication lasers operating at 1.55μm forces to make a structure which would be most suitable for this wavelength range.

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