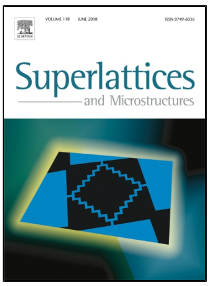
Accepted Manuscript



Thin Film Tandem Nanoplasmonic Photoconductive Antenna for High Performance Terahertz Detection

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PII:	S0749-6036(18)30935-2
DOI:	10.1016/j.spmi.2018.06.029
Reference:	YSPMI 5764
To appear in:	*Superlattices and Microstructures*
Received Date:	07 May 2018
Accepted Date:	15 June 2018

Please cite this article as: Saman Ghorbani, Mohammad Bashirpour, Jafar Poursafar, Mohammadreza Kolahdouz, Mohammad Neshat, Amirali Valinejad, Thin Film Tandem Nanoplasmonic Photoconductive Antenna for High Performance Terahertz Detection, *Superlattices and Microstructures* (2018), doi: 10.1016/j.spmi.2018.06.029

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Photoconductive antennas (PCA) have attracted lots of attention for terahertz application, due to their room temperature operation and compact design. On the other hand, their main problem is acquiring low output power. Lately, plasmonic structures of different geometries have been proposed to overcome the mentioned issue. Here, we have proposed and simulated a PCA on a silicon-on-sapphire substrate and a layout of a plasmonic nanostructure in which the effect of geometrical parameters of the nanostructure on PCA's output was investigated and optimized. According to the results for one layer plasmonic nanostructure, two different geometries showed more than 700% improvement in the device photocurrent which are related to different types of surface plasmons. By combining these layouts and benefiting from both simultaneously, a final proposed nanostructure was constructed. After optimizing the new structure's parameters, a significant increase of 15400% in photocurrent enhancement was achieved by comparing to the conventional THz PCAs on similar substrate.

Keywords: Terahertz; Plasmonics; Nanostructures; Photoconductive Antenna.

Introduction

Photoconductive antennas (PCAs) are one of the most common terahertz (THz) pulsed sources with interesting properties such as room temperature operation, broadband radiation and compact design. The main drawback of conventional PCAs is their low output power which is about a few tens of microwatts [1–3]. There has been a great deal of effort to improve the efficiency of PCAs and increase their THz radiation. One of the most promising method is based on using metallic nanostructure (NS) in the gap of the antennas which by enhancing the local optical electric field in the substrate results in an increase in the photocarrier generation and thus the photocurrent [4–