ULTRAFAST MULTIPLE-TM-DOPED SHORT-PERIOD SUPERLATTICE PHOTOCONDUCTORS FOR EFFICIENT THZ ANTENNAS IN KEY EMERGING TECHNOLOGIES

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HINTERGRUND

Within photoconductors of previous design photosensitive semiconductors can only be optimized towards either electron-hole recombination time or electric resistance. Since the optimum of the one is never the optimum of the other, previous state of the art photoconductors are decidedly less efficient then the proposed ultrafast Multiple-Transition-Metal-doped Short-Period Superlattice Photoconductor.

LÖSUNG

A photoconductor as proposed consists of pairs of differently doped very thin (<10nm) layers of semiconductors. Both layers are doped with arbitrary transition-metals (TM) (like Fe, Rh, Ru, or others). Essential is that layer 1 and layer 2 have at least an order of magnitude different doping concentration. The goal is to reach a homogeneous dopant distribution in one layer, and a profound TM-cluster (or other defects) formation in the other layer. Thus the functionality of electrical compensation and the functionality of fast carrier recombination can be split over two layers with different doping levels meaning both functionalities can be optimized simultaneously. These pairs of layers can be optionally mended with spacer layers to prevent interdiffusion of the dopands and this structure is repeated until the total thickness of all layers is between 0,5µm and 2µm.

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ENTWICKLUNGSSTAND

Labormuster

PATENTSITUATION

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CATEGORIES

//Nanotechnologien //Halbleiter

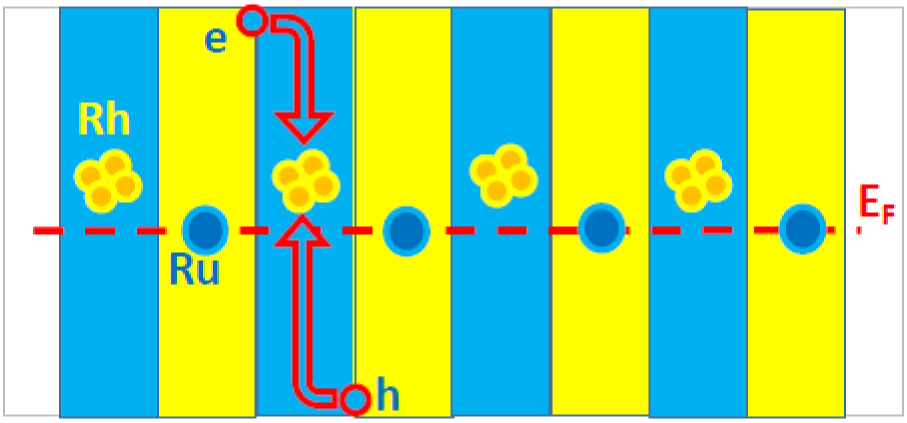

Illustration of the functionality of the dually-doped short-period-superlattice photoconductor. Ru-doped layers pin the Fermi level EF in the middle of the semiconductor band-gap, resulting in a high electrical resistance of the material. Rh clusters in the alternating layers provide the ultra-fast electron-hole recombination centers, resulting into ultra-short recombination times.

ANWENDUNGSBEREICHE

These photoconductors can be used for terahertz (THz) antennas which are important for transmitting and receiving THz electromagnetic waves in emerging THz systems, e.g. security systems for detecting hazardous material or quality management systems for detecting material defects. Due to small sizes THz antennas usually suffer from a high loss in performance. Since THz waves don’t alter the chemical structure – thus making them safe for use on living beings in contrast to UV and x-ray radiation – THz systems are considered a key future technology.

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