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Realisation of a photoactive structure on n-GaSb (100)

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Abstract

The invention is about defining a new structure for a photosensitive device on n-GaSb in near IR region.
Gallium antimonide (GaSb) is an III-V semiconductor compound with zinc blend crystal structure and direct band gap energy of 0.726 eV. It is a substrate material in device technology and it allows operation on a wide spectral range (0.8 ÷ 4.3 μm). Consequently, GaSb is an important competitor for solar energy conversion e.g. high efficiency thermo-photovoltaic (TPV) cells.
The n-GaSb substrates were chemically prepared by cleaning and selective etching, and afterwards were irradiated with 1 MeV Si^{1+} for defining an active p-n junction at a precise level of local doping.The technological procedure included a recovery treatment and for defining the device structure, the metals were vacuum deposited in order to obtain ohmic contacts on p-n junction, as PdGeAu/n-GaSb and Ag/p-GaSb.
We obtained a photosensitive structure with a maximum photo-current response at 1.5 μm. The photo-sensitive structure response in IR region indicates as regarding responsivity characteristics the presence of a competitive device on the market.

Advantages

- the use of ion implantation as a doping technique, offering precise and accurate controle of dose and depth profile;
- the use of Si^{+} ions for p-type doping in GaSb (group IV atoms such as Si are well known as amphoteric dopants of III-V compounds);
- the ohmic contact PdGeAu/n-GaSb is a premiere that ensures a linear current versus voltage (I-V) characteristics, with a curve slope R ~ 10 ÷ 14 Ω; in addition, this contact is made by successive deposition in medium vacuum conditions;
- the realisation of Ag/p-GaSb contact ensures a linear current versus voltage (I-V) characteristics, with a curve slope R ~ 10 Ω;
- The use of a commercial support for device encapsulation (adapted TO-3 package).

Applications

- Biological and medical aplications, optoelectronic and metal-insulator-semiconductor (MIS) devices.

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