Nonalloyed ohmic contacts to n-GaAs

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Takaaki Mano
Optical Materials Field / Epitaxial Nanostructures Group
MANO.Takaaki@nims.go.jp | https://samurai.nims.go.jp/profiles/mano_takaaki

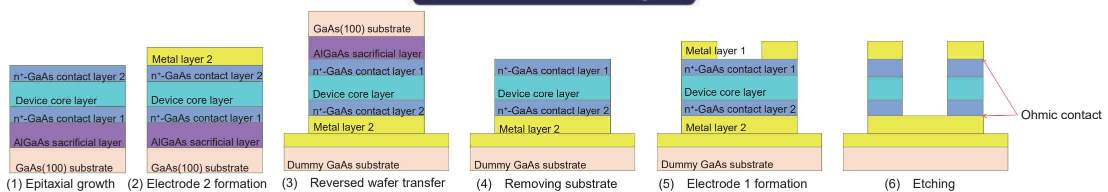
Background

- Semiconductor optical devices for environmental measurement and monitoring.
- Highly functional devices by using metal-semiconductor-metal resonators.
- Striking a good balance between electrical and optical functionalities of metal-semiconductor interfaces.

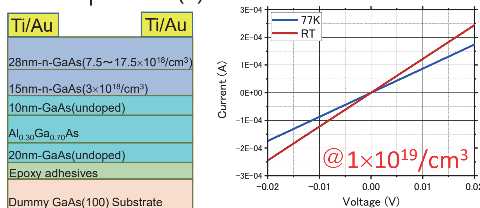
Aim

- Establishment of elemental technology for integrating metasurface and semiconductor optical devices.
- Realizing abrupt metal-GaAs interfaces with ohmic properties.

Advanced Research Topics



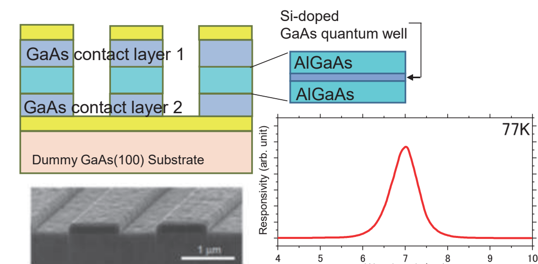
Schematic drawing of optical device fabrication process including crystal growth and reversed wafer transfer. In process (2), nonalloyed ohmic contact to the top n-GaAs can be formed by the existing technologies. But it was difficult to realize nonalloyed ohmic contact to the bottom n-GaAs in process (5).



RT : $3.6\times10^{-3}\,\Omega\text{cm}^2$

77K : $1.5\times10^{-2}\,\Omega\text{cm}^2$

Schematic drawing of optimized bottom contacts and their I-V property at RT and 77K. Nonalloyed ohmic contacts are realized by tuning the doping density and growth temperature.



Schematic drawing and electron microscope image of metasurface quantum well IR photodetectors. Due to the nonalloyed ohmic contacts, high responsivity at 7µm is realized.

Publications

- Patent application: 2018-037337
- The 65th JSAP Spring meeting , 18p-P8-7, 19a-C301-10, 2018

Summary

- Nonalloyed ohmic contacts to top and bottom n-GaAs contact layers.
- Optimization of doping density and substrate temperature during the growth.

Research outcome

- Metal-GaAs-metal optoelectronic devices.
- Highly sensitive IR photodetector.