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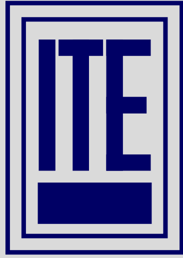

Development of Low Density Gallium Nitride Substrates DENIS G5RD-CT-2001-00566

COORDINATOR

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PARTICIPANTS

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- Linköping University, Linköping, Sweden
- High Pressure Research Centre, Polish Academy of Sciences, Warsaw, Poland
- Okmetic, Finland
- Universität Bremen, Germany
- OSRAM-Opto Semiconductors GmbH, Germany

subcontractors

- Institute of Electron Technology, Warsaw, Poland
- Institute of Physics, Polish Academy of Sciences, Warsaw, Poland

PROJECT DESCRIPTION

The project will develop a growth technique suitable for the production of GaN wafers. To achieve production grade material the defect concentration and in particular dislocation density must be reduced by more than 3 orders of magnitude compared with the standard material of today. Commercial production implies a well controlled, reproducible and scaleable technique, demands that are met by the use of Hydride Chemical Vapour Deposition (HCVD).

Material quality will be evaluated using a number of device demonstrators, a UV LED, a high power HEMT and a violet laser diode. These devices will not be developed as part of the program, but structures based on existing technology at the respective partner organisations will be manufactured. In terms of device goals the project aims to demonstrate dramatically improved performance that will motivate a rapid uptake of Nitride technology in Europe.

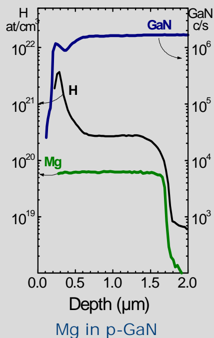
OUR ROLE IN THE PROJECT

To develop, characterise and deliver to the University of Bremen the technology of low resistivity, reliable p-type ohmic contacts to GaN-based laser diodes.
A key objective is to find out the correlation between the contact characteristics and the properties of the semiconductor subcontact region (carrier and dopant concentration profiles, crystalline structure, surface properties) and the properties of the metallization itself (contact material, method of deposition, microstructure, processing).

RESULTS

Two approaches have been undertaken to solve the problem of reliable low-resistivity ohmic contacts:
- searching for metallization systems enabling enhanced activation of Mg in subcontact region of p-GaN;
- tailoring the barrier height at the metal/semiconductor interface via chemical treatment of semiconductor surface and/or the choice material and method of deposition for contact metallization.

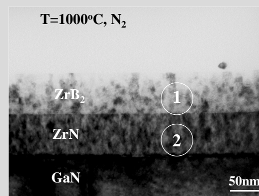
p-GaN ohmic contacts through enhanced activation of Mg

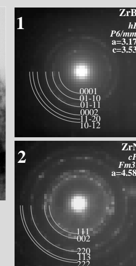


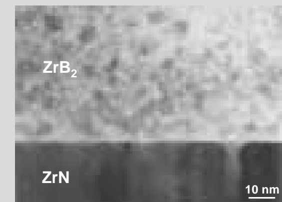
Mg in p-GaN

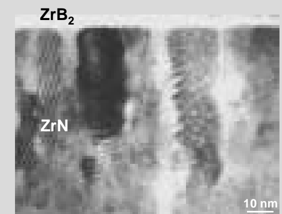
Processing steps:

- surface treatment
- 1st metallization: ZrN/ZrB_2/(50nm/50nm) rf magnetron sputtering from ZrN & ZrB_2
- photolithography & RIE
- annealing: RTP @ 950^{0}C in N_2
- photolithography lift-off
- 2nd metallization: Ag (100 nm)









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