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Department of Semiconductor Processing for Photonics

Advanced Magnetic Oxides for Responsive Engineering AMORE G5D-CT-2000-0138

COORDINATOR

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•Institute of Electron Technology, Warsaw, Poland

PROJECT DESCRIPTION

AMORE will develop a new generation of ferromagnetic half-metallic oxides and demonstrate their potential in patterned nanoscale magneto resistance. The key idea is to exploit the high degree of spin polarisation of these chemically-stable oxides to achieve large magneto resistive effects in the practical temperature range up to 120°C. For this, an understanding of spin transport at grain boundaries and interfaces in these materials is required. Having selected the most suitable of the new double perovskite oxides, the aim is to evaluate the technical and economic feasibility of magneto-resistive elements fabricated from them by two routes: 1) Screen printing - low-cost technique suitable for making contact less potentiometers for the auto industry among others, and 2) Epitaxial thin-film growth for planar tunnel junctions suitable as magneto electronic elements. A new generic materials technology for sensitive, robust, low-cost components will be launched, which will boost European competitively in a fast-changing field.

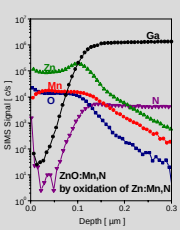
OUR ROLE IN THE PROJECT

•Optimisation of methods of preparation of Zn-based oxides with a fraction of substitutional manganese and nitrogen, and development of patterning technique and ohmic contact fabrication to Zn-based oxides.
•Optical, electrical structural characterisation of newly developed materials.

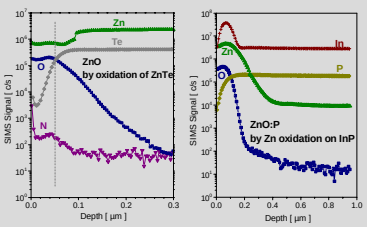
The above tasks are being realised in a close collaboration with Growth and Physics of Low-Dimensional Crystals Lab & Low Temperature Physics Group, Institute of Physics PAS.

RESULTS

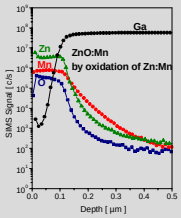
•Several approaches for the fabrication of Zn-based oxides doped with manganese and nitrogen have been developed. Specifically, sputter deposition of ZnO and thermal oxidation of thin films of Zn, either MBE or vacuum deposited, doped with Mn and N.
•Photolithographic processing of ZnO-based thin films and ohmic contact fabrication to these materials have been developed.
•Transport measurements together with secondary ion mass spectroscopy (SIMS) analysis are carried out to gain information on effectiveness of the nitrogen doping (i.e., the degree of compensation). SIMS is also used to assess the concentration of manganese. Complementary information on this quantity is obtained by photoluminescence measurements.
•Samples characterised optically and electrically are subject of magnetic measurements in a superconducting quantum interference device (SQUID) magnetometer.
•To study the microstructure of newly developed materials complementary analytical methods such as atomic force microscopy (AFM), magnetic force microscopy (MFM), ellipsometry (VASE), and transmission electron microscopy (TEM) methods are employed.

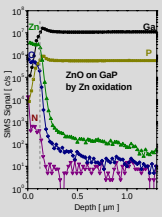


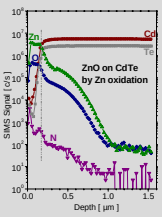
ZnO by oxidation of Zn HT@320^{0}C,O_2



ZnO by rf sputter deposition from ZnO target







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