Biocatalytic Activity of Enzymes Immobilized on Group III-Nitride Surfaces — BARBARA BAUR, GEORG STEINHOFF, HANS-GEORG VON RIBBECK, YVONNE GAWLINA, FLORIAN FURTMAYR, MARTIN STUTZMANN, and MARTIN EICKHOFF — WALTER SCHOTTKY INSTITUTE, TECHNISCHE UNIVERSITÄT MÜNCHEN, 85748 GARCHING, GERMANY

AlGaN/GaN electrolyte gate field effect transistors (EGFETs) have a great potential as sensor devices for electronic detection of biochemical processes, as they combine excellent electronic characteristics with biocompatibility and long term stability in liquid electrolytes. In addition, they show a high pH sensitivity, which enables the quantitative electronic detection of enzymatic biocatalytic reactions accompanied by local pH changes. In this context, we describe the covalent immobilization of different enzymes on GaN surfaces. The influence of the pH-value in the chemical medium during the immobilization processes has been investigated. Adjustment of the pH-value results in selective covalent immobilization at croslinker molecules on a self assembled monolayer of aminopropyltriethoxysilane (APTES) deposited on the surface. At the same time, the non-specific physisorption due to electrostatic interaction can be suppressed, as proven by fluorescence microscopy. The influence of the immobilization process on the enzyme activity and long-term stability is analyzed by photometric measurements. The biocatalytic activity of immobilized penicillinase and urease is detected electronically, employing the ion sensitivity of the underlying AlGaN/GaN EGFETs.

We show analytically that the exciton energy in nitride quantum dots (QDs) decreases linearly with increasing dot height, provided that the height to radius ratio remains constant. This behaviour is due to the strong polarization fields present in nitride dots, with the constant of proportionality given by the slope of the polarization potential. We also present a useful analytical approximation for the electron and hole wavefunctions in nitride QDs in terms of Airy functions, which provides reliable estimates for the actual energies and wavefunctions.

Physical Model to explain and predict performance of AlGaN/GaN-based MIS-HFETs — GERÖ HEIDELBERGER1, MICHEL MARSO1, ALFRED FOX1, JURAJ BERNAT2, HANS LÜTH1, and PETER KORDOS2 — 1INSTITUTE OF THIN FILMS AND INTERFACES AND CNI - CENTER OF NANOELECTRONIC SYSTEMS FOR INFORMATION TECHNOLOGY, RESEARCH CENTRE JULICH, D-52425 JULICH, GERMANY — 2INSTITUTE OF ELECTRICAL ENGINEERING, SLOVAK ACADEMY OF SCIENCES, SK-84104 BRATISLAVA, SLOVAKIA

We were able to demonstrate the superiority of the MIS-HFET concept with regards to DC and RF power performance.