DENSITY-OF-STATES IN MICROCRYSTALLINE SILICON FROM THERMALLY-STIMULATED CONDUCTIVITY
— Nacera Souffi, Rudolf Brüggemann, and Gottfried H. Bauer — Institut für Physik, Carl von Ossietzky Universität Oldenburg, D-26111 Oldenburg

The technique of thermally stimulated currents has been applied to extract the density-of-states profile in microcrystalline silicon. Exploiting the experimental parameter space a consistent density-of-states profile emerges with an exponential conduction band tail and a broader deeper Gaussian broadening. The calculated temperature dependence of the resistivity of paramagnetic Ga\textsubscript{1-x}Mn\textsubscript{x}As with x up to 7% — C. Michel, S. Ye, V. Rajeva, P. J. Kläui, S. D. Baranovskii, P. Thomas, W. Heimbrodt, and B. Gol’dücke — 1Dept. Physics and WZMW, Philips-University of Marburg, Germany — 2MPI for Computer Science, Saarbrücken, Germany

We measured and modelled quantitatively the magneto-resistance behaviour above the Curie-temperature of several different p-type Ga\textsubscript{1-x}Mn\textsubscript{x}As samples with x up to 7%. A network model [1] accounting for alloy disorder and tuning of the band structure due to the strong s-p exchange interaction between the spins of the extended band states and the localized Mn 3d spins was employed. The band structure description is based on parabolic hole bands and an acceptor level with the integral of the photocurrent transients depend on the example of porous TiO\textsubscript{2} layers sensitized with dye molecules. The surface photovoltage method is a locally sensitive technique with the examples of porous semiconductor devices — Thomas Dittrich, Iván Mora-Seró, Germá García-Belmonte, and Juan Bisquert — 1Hahn-Meitner-Institut, Glienicker Str. 100, 14109 Berlin, Germany — 2Departement de Ciències Experimentals, Universitat Jaume I, E-12080 Castelló, Spain

UV photodiodes (sgux tw308x, TiO\textsubscript{2} made by sol-gel processing) were used as a model system to study Ti / TiO\textsubscript{2} / Pt - Schottky diodes by temperature dependent current-voltage, impedance spectroscopy and transient photocurrent measurements. The equivalent circuit has been taken into account for the analysis. The Schottky barrier is about 1.3 eV which is equal to the work function difference between Ti and Pt. At lower potentials, the current is limited by the barrier while at higher potentials, control by space charge limited currents sets on. The temperature dependent dielectric constant of the TiO\textsubscript{2} layer was obtained. Photocurrent transients were excited with short UV laser pulses. The current at 1 ms and the integral of the photocurrent transients depend linearly on the laser intensity until an electron density of about 10\textsuperscript{12} cm\textsuperscript{-2} is reached in the TiO\textsubscript{2} layer (thickness 160 nm). At higher intensities, the photocurrent goes to saturation due to recombination. The electron drift mobility depends only weakly on the illumination intensity and temperature.

Source switching in an electron Y-branch switch — Stefan Lang, David Hartmann, Lukas Worschech, and Alfred Förchel — Technische Physik, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany

We have observed gate controlled source switching in an electron Y-branch switch. The Y-branchued nonjunctions were realized on the basis of a modulation doped $\text{GaAs/AlGaAs}$ heterostructure. The two rows define three electron reservoirs, which are leaky coupled to each other. We have determined the current voltage characteristics for several possible variations of the three terminals for different separations between the rows and different hole diameters. For row separations in the order of 1 $\mu$m transistor characteristics have been observed even at room temperature, which we discuss in terms of a leaky capacitor model.}

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resistance effects are very sensitive to the choice of model parameters, e.g. the valence band exchange-integral $\alpha$, the width of the Gaussian broadening of the acceptor level, the degree of zero-field disorder etc., allowing one to determine these parameters by fitting the experimental data. The magnitude of the extracted parameters and the trends with $x$ will be discussed and compared with literature values.

Semiconductor Physics

Admittance of open quantum systems — 1Paul Racec1,2, Roxana Racec1,2, and Ulrich Wulf1,2 — 1IHP/BTU Joint Lab, Postfach 101344, 03013 Cottbus, Germany — 2National Institute of Materials Physics, PO Box MG-7, 077125 Bucharest Magurele, Romania

We present a formalism for the treatment of mesoscopic systems under a small time dependent bias superimposed to a static external bias which defines the working point. The scheme is based on linear response theory, where the unperturbed system is considered the system under the static external bias. For the unperturbed system, Hartree calculations are performed in the Landauer-Büttiker formalism. In order to describe the time dependent quantities, the corresponding response functions (charge-charge or current-current correlations functions) are computed in the random phase approximation. Applications for blocking structures (like metal-insulator-semiconductor) and current carrying structures (like double barrier resonant tunneling diode) are presented. Based on quantum mechanical expressions for their admittance, equivalent small signal circuits are proposed.

Photoexcited electron and hole transport in thin film tunnel systems — 1Peter Thissen1,2, Domokos Kovacs2, Jörg Winter2, Eckart Hasselbrink1, and Detlef Diesing2 — 1Institut für Physikalische Chemie, Universität Duisburg Essen — 2Institut für Experimentalphysik 2, Ruhr Universität Bochum

The photoeffect in semiconductor based devices is often discussed as transport of the majority carriers across the metal-semiconductor interface. The photoexcited charge carriers propagate over the Schottky barrier ($E_{tunnel} \approx 0.7 \text{eV}$ for silicon-metal interfaces). In tunnel barrier systems (metal$_1$-metal$_2$oxide-metal$_3$) with thin oxide layers ($\approx 3 \text{nm}$) and metal films ($10 - 70 \text{nm}$) other transport channels may also contribute to the measured photocurrent: 1. tunneling of electrons through the conduction band barrier. 2. tunneling of holes through the valence band barrier. 3. excitation of charge carriers both in the top and in the ground metal film of the tunnel device. By applying a bias voltage between the metals, the band structure of the tunnel device can be changed allowing a discrimination between the different transport channels. Photoinduced tunnel currents ($h \nu = 1.53, 1.37, 1.27 \text{eV} < E_{tunnel} = 1.8 \text{eV}$) were investigated as well as photoinduced UV-electronic excitations ($h \nu = 11 \text{eV} \gg E_{tunnel}$) with different bandstructures in the the tunnel devices. The investigations show a clear contribution of hot hole induced tunnel currents to the measured photo current even in the low energy range. Transport effects of excited charge carriers in the metal films are discussed referring to experiments with variable metal film thicknesses.

Non-linear I-V characteristics of nano-transistors in the Landauer-Büttiker formalism — 1Ulrich Wulf1,2, Paul Racec1,2, and Alexandru Nemnes1,2 — 1Technische Universität Cottbus, Fakultät 1, Postfach 101344, 03013 Cottbus, Germany — 2National Institute of Materials Physics, PO Box MG-7, 077125 Bucharest Magurele, Romania — 3Institut für Physik, Technische Universität Chemnitz, 4University of Bucharest, Faculty of Physics, PO Box MG-11, 077125 Bucharest Magurele, Romania

We present the non-linear I-V characteristics of a nanoscale metal-oxide-semiconductor field-effect-transistor in the Landauer-Büttiker formalism. In our three-dimensional ballistic model the gate, source and drain contact are treated on an equal footing. As in the drift-diffusion formalism, Hartree calculations are performed in the Landauer-Büttiker formalism. In order to describe the time dependent quantities, the corresponding response functions (charge-charge or current-current correlations functions) are computed in the random phase approximation. Applications for blocking structures (like metal-insulator-semiconductor) and current carrying structures (like double barrier resonant tunneling diode) are presented. Based on quantum mechanical expressions for their admittance, equivalent small signal circuits are proposed.

Thermoelectric cooling: a new approach — 1G.N. Logvinov1, J. E. Velázquez2, and Yu. G. Gurevich1,2 — 1SEP-E-ESIME Culhuacan, I.P.N., Santa Ana 1000, Culhuacan, C.P. 04430, D.F., Mexico — 2Dep. de Física Aplicada, Universidad de Salamanca, Pza. de la Merced/n, E-37008 Salamanca, Spain — 3On leave at the University of Salamanca. Permanent address: Dep. de Física, CINVESTAV-IPN, D.F., Mexico

A new approach is suggested to explain the Peltier effect. It assumes that the Peltier effect is not an isothermal effect. The approach is based on the occurrences of induced thermal fluxes in a structure which consists of two conducting media, through which a dc electric current flows [1]. These induced thermal diffusion fluxes arise to compensate for the change in the thermal flux caused by the electric current (the drift thermal flux) flowing through the junction, in accordance with the general Le Chatelier-Braun principle. The occurrence of these thermal diffusion fluxes leads to temperature heterogeneity in the structure and, as a result, to a cooling or heating of the junction. Within the framework of this concept, the thermoelectric cooling is analysed. It is shown that in the general case the Peltier effect always occurs together with another thermoelectric effect [1]. This thermoelectric effect is predicted for the first time. Both these effects essentially depend on the junction surface thermal resistance [2].