MM 42: Topical Session Multifunctional Materials III

Time: Wednesday 14:45–16:15 Location: H6

Topical Talk MM 42.1 Wed 14:45 H6

Multifunctional semiconductor nanowires for photonic applications — •Carsten Ronning — Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena

Semiconductor nanowires are of major importance within the area of nanotechnology, and are usually synthesized using the so-called vapor-liquid-solid (VLS) mechanism. They serve as both functional units and as the wires that access them; therefore, they are ideal building blocks for multifunctional nanoscale devices. Applications and prototype devices based on semiconductor nanowires have been realized in various areas: in electronics, photonics, mechanics, and sensors. I will just summarize and focus this presentation on the use of zinc oxide nanowires for photonic applications: this will include waveguiding [1], light emitting diodes [2] and lasers [3].

[1] High order waveguiding modes in ZnO nanowires - T. Voss, G.T. Svacha, E. Mazur, S. Mueller, C. Ronning, D. Konjhodzic, F. Marlow, Nano Letters 7 (2007) 3675

[2] Scalable fabrication of nanowire photonic and electronic circuits using spin-on glass - M. Zimmler, F. Capasso, D. Stichtenoth, C. Ronning, W. Yei, V. Narayanamurti, T. Voss, Nano Letters 8 (2008) 1695

[3] Laser action in nanowires: Observation of the transition from amplified spontaneous emission to laser oscillation - M. Zimmler , J. Bao , F. Capasso , S. Mueller , C. Ronning, Appl. Phys. Lett 93 (2008) 051101

Topical Talk MM 42.2 Wed 15:15 H6

Interfaces in multifunctional perovskite oxides — •Christian Jooss[1], Joerg Hoffmann[1], Jonas Norpoth[1], Malte Scherff[1], Björn-Uwe Meyer[1], Gesine Saucke[1], and Yimei Zhu[2] — [1]Institute of Materials Physics, University of Goettingen, Germany — [2]Center for Functional Nanomaterials, Brookhaven National Laboratory, USA

Perovskite oxide materials with strong electronic or electron-lattice correlations exhibit a fascinating variety of properties from ferroelectricity over colossal resistance effects to high-temperature superconductivity. In these materials, interfaces can have a tremendous effect on the local electronic properties. This can give rise to new interfacial phases and properties which are absent in the bulk. Often, the interfacial properties strongly depend on subtle details in the atomic structure such as chemical termination layers, octahedral tilting, strain and strain relaxing interfacial defects. Therefore, the study of interfaces in perovskite oxides is a challenging subject of materials science. Topics in this talk span from the resistive switching effect at metal-manganite interfaces in pulsed electric field over new types of solar cells with correlated pn-junction to manganite-cuprate interfaces with local variation in hole doping and correlation interactions. Based on atomically resolved structural and chemical analysis, particular emphasis will be put on the study of the mechanisms of charge transfer across interfaces in the strongly correlated electron and lattice system. We give insights that well-designed oxide hetero-interfaces show a huge potential for new applications in electronics and energy conversion.

MM 42.3 Wed 15:45 H6

Diffractive optics on contact lens: application of electron beam lithography on polymer material with curved structures — •Xin Jin[1], Dawit Gedamu[1], Rainer Adelung[1], Dirk Meyners[2], Eckhard Quandt[2], Matthias Kaläne[2], Kai Rossnagel[3], Lutz Kipp[3], and Frank Spors[4] — [1]Functional Nanomaterials, Institute of Materials Science, CAU Kiel, Germany — [2]Inorganic Functional Materials, Institute of Materials Science, Faculty of Engineering, CAU Kiel, Germany — [3]Electronic Structure / Synchrotron Radiation, Institute for Experimental and Applied Physics, CAU Kiel, Germany — [4]College of Optometry, Western University of Health Sciences, Ca, USA

The principle of a diffractive bifocal contact lens was first suggested in the 1980s in the treatment for presbyopia. But the products were not successful due to problems with the reduction of the contrast in the patient*s vision. However, with progress in both the fabrication method and the design of diffractive optics (e.g., photon sieves), the question about the application of diffractive optics on contact lenses can be asked again. Therefore, in this research, zone plates and photon sieves are manufactured on contact lenses using electron beam lithography (EBL). furthermore, the problems of applying EBL on polymer contact lenses employing curved surfaces are discussed.

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MM 42.4 Wed 16:00 H6

Crossing an interface: Tuneable spin polarisation by means of electric charge — Mike Hambe[1], Adrian Petraru[2], Nikolay A. Pertsev[3], Valanoor Nagarajan[1], and •Hermann Kohlstedt[2] — [1]School of Materials Science & Engineering, University of New South Wales Sydney NSW 2052, Australia — [2]Nanoelektronik, Technische Fakultät, Christian-Albrechts-Universität zu Kiel, D-24143 Kiel, Germany — [3]A. F. Ioffe Physico-Technical Institute, Russian Academy of Science, 194021, St. Petersburg, Russia

We present experimental results on entirely complex oxide La0.67Sr0.33MnO3/BiFeO3/La0.67Sr0.33MnO3 ferromagnetic-ferroelectric-ferromagnetic tunnel junctions. The junctions were deposited by Pulsed Laser Deposition in a layer-by-layer growth mode and patterned by standard thin-film processing. We show that our devices posses a traditional Tunneling Magneto Resistance (TMR) ratio ~80% below 100 K, but that by inducing ferroelectric switching via an applied electric field of about 770 kV/cm, we can modulate the anti-parallel state resistance state as well as the TMR ratio. The experiments indicate a possible tuneable orbital reconstruction at ferromagnetic-ferroelectric interfaces via the remnant charge of the ferroelectric. The results will be discussed in the framework of the predicted magnetoelectric interface effect and may lead to novel multistate memory devices.