HL 68: II-VI Semiconductors: mainly Optical Properties

Time: Friday 11:30–12:45 Location: H17

HL 68.1 Fri 11:30 H17

Dynamical control of Mn spin system cooling by photogenerated carriers in (Zn,Mn)Se/BeTe heterostructures — •Daniel Dunker[1], J. Debus[1], A. A. Maksimov[2], D. R. Yakovlev[1], I. I. Tartakovskii[2], and M. Bayer[1] — [1]Experimentelle Physik II, Technische Universität Dortmund, 44227 Dortmund, Germany — [2]Institute of Solid State Physics, Russian Academy of Sciences, 142432 Chernogolovka, Russia

We study magnetization dynamics in undoped $Zn_{0.99}Mn_{0.01}Se$/BeTe type-II quantum wells by means of time-resolved pump-probe-control and photoluminescence techniques. Measurements at a magnetic field of 3 T and a temperature of 1.8 K show under pulsed excitation of a control laser a strong decrease of the excitonic giant Zeeman shift which leads to a reduction of the Mn ion spin temperature. Its dynamics was studied with a nanosecond time resolution.

The band alignment of the type-II heterostructure results in a spatial separation of the thermalized electrons and holes in the (Zn,Mn)Se and BeTe layers, respectively, and this causes long radiative lifetimes of photocreated electrons. The magnetization relaxation of the Mn spin system is accelerated by the efficient transfer of spin and energy from the Mn ions to the lattice via the electrons localized in (Zn,Mn)Se layers. The strength of the laser induced cooling effect is controlled with the optical excitation density. The overall temporal evolution of the Mn spin system cooling is also influenced by the heating impact on the Mn ions of the holes, localized in BeTe, as well as by non-equilibrium phonons.

HL 68.2 Fri 11:45 H17

Optical characterization of CdSe/Cd(S,Se)/ZnS core-shell-shell collodial quantum dots — •Martin Pohl[1], Sergey Skripets[1], Martin Kneip[1], Dmitrii Yakovlev[1], Manfred Bayer[1], Celso Mello-Donega[2] und Daniel Vanmaekelbergh[2] — [1]Experimentelle Physik E2, TU Dortmund, Deutschland — [2]Debye Institut, Universität Utrecht, Niederlande

The optical properties of collodial CdSe/Cd(S,Se)/ZnS core-shell-shell quantum dots with varying dot density were studied by means of optical methods. In these systems, electrons, holes and excitons are strongly confined in the nanocrystal host, resulting in discrete energy levels for these nanocrystals. Investigations were performed in resonant and nonresonant excitation regime over a wide temperature range from 2 up to 300 K with magnetic fields between 0 and 10 T. Furthermore the relaxation time of the photoluminescence was studied in picosecond range by means of streak camera and nanosecond range by means of gated ccd.

The workings were done in the framework of the Herodot-program "heterogeneous quantum rod and quantum dot nanomaterials" at the physics department of the TU Dortmund with samples grown at the University of Utrecht.

HL 68.3 Fri 12:00 H17

Methods for polarized light emission from CdSe quantum dot based monolithic pillar microcavities — •Moritz Seyfried, Joachim Kalden, Kathrin Sebald, Jürgen Gutowski, Carsten Kruse, and Detlef Hommel — Institute of Solid State Physics, University of Bremen, P.O. Box 330 440, D-28334 Bremen, Germany

A lifting of the polarization degeneracy of the fundamental cavity mode in pillar microcavities (MCs) would allow for controlling the polarization state of the emitted photons. Therefore, monolithic VCSEL structures were grown by molecular beam epitaxy containing either one CdSe/ZnSSe quantum dot layer or three quantum well layers as active material. By using focused-ion-beam etching, MC pillars with different geometries were prepared out of the planar samples. Among these are circularly shaped pillar MCs with diameters in the range from 500 nm up to 4 μm and quality factors of up to 7860, elliptically shaped MCs, and so-called photonic molecules consisting of circular pillar MCs which are connected by small bars. Polarization dependent photoluminescence investigations of the fundamental cavity mode reveal a lifting of the polarization degeneracy for all three types of MCs. The energy splitting of up to 0.42 meV in the circularly shaped pillar MCs is probably caused by anisotropic strain conditions within the sample and directly dependent on the pillar diameter, whereas the larger energy splitting of up to 0.72 meV for the photonic molecules or even 4.5 meV for the elliptically shaped MC is based on their asymmetric cross sections.

HL 68.4 Fri 12:15 H17

Diffusionsmessungen in CdTe mittels ortsaufgelöster Photolumineszenzspektroskopie — •R. Gerten, F. Strauss, J. Kronenberg, H. Wolf und Th. Wichert — Technische Physik, Universität des Saarlandes, 66123 Saarbrücken, Germany

In Radiotracer-Experimenten ist gezeigt worden, dass nach Diffusion von Gruppe I Elementen in ca. 800 μm dicken CdTe Kristallen peakförmige, bezüglich des Kristallzentrums symmetrische Konzentrationsprofile beobachtet werden [1]. Motiviert durch diese Ergebnisse wurde eine Apparatur für ortsaufgelöste Photolumineszenzspektroskopie (μPL) aufgebaut, um Defektprofile ohne die Verwendung radioaktiver Isotope und nahezu zerstörungsfrei zu bestimmen. Erste Messungen zeigen an nominell undotierten Proben nach Tempern für 60 Minuten bei 800 K unter Cd-Atmosphäre tiefenaufgelöste PL-Signale mit Intensitätsprofilen, die den Diffusionsprofilen von Gruppe I Elementen nach gleichartiger thermischer Behandlung entsprechen. Dabei zeigt der Verlauf der Intensität für die akzeptor- und donatorgebundenen Exzitonen ein komplementäres Verhalten, ähnlich wie in [2] berichtet. Offensichtlich werden durch interstitiell eindiffundierende Cd Atome pn-Übergänge im Innern des Kristalls erzeugt, wobei die mobilen, elektrisch geladenen Defekte dem Verlauf des Potentials folgen. Damit lassen sich sowohl die Tracer-Diffusionsprofile als auch die μPL-Profile konsistent erklären. Gefördert durch das BMBF, Projekt 05 KK1TSB/5 [1] H. Wolf et al., Phys. Rev. Lett. 94 (2005) 125901 [2] P. Horodyský et al., Phys. Stat. Sol. 2 (2005) 1189

HL 68.5 Fri 12:30 H17

Size-dependent recombination dynamics in ZnO nanowires — •Juan Sebastian Reparaz — Institut für Festkörperphysik - Technische Universität Berlin Hardenbergstr. 36, Sekr. EW 5-1, D-10623 Berlin, Germany

A deep understanding of the recombination dynamics of ZnO nanowires is a natural step for a precise design of on-demand nanostructures based on this material system. In this work we investigate the influence of finite-size on the recombination dynamics of the neutral bound exciton around 3.365 eV for ZnO nanowires with different diameters. We demonstrate that the lifetime of this excitonic transition decreases with increasing the surface-to-volume ratio due to a surface induced recombination process. Furthermore, we have observed two broad transitions around 3.341 and 3.314 eV, which were identified as surface states by studying the dependence of their life time and intensitiy with the NWs dimensions.