TECHNISCHE UNIVERSITÄT CHEMNITZ

PHYSIKALISCHES KOLLOQUIUM

Mittwoch, den 14.04.2010, um **15:30 Uhr**

Ort: Reichenhainer Str. 90; Neues Hörsaalgebäude, Raum: 2/N013

VORSTELLUNGSVORTRAG

zum Habilitationsverfahren

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Scattering Phonons and Trapping Excitons with Self-assembled Quantum Dots

Semiconductor quantum dots (QDs) are systems which confine the motion of electrons and/or holes in all directions and in regions of space which are comparable to the electron/hole De Broglie wavelength. From this point of view, QDs can be seen as “artificial atoms” with engineerable properties. QDs can be made as nanoinclusions of a low energy bandgap material in a matrix with larger energy bandgap. One of the simplest ways to obtain QDs with excellent structural, electronic, and optical properties is represented by self-assembly of nanoislands during lattice-mismatched heteroepitaxial growth. Envisioned applications of QDs are in the fields of optoelectronics, quantum information processing and communication, and thermoelectrics. Besides the technological interest, QDs offer a wealth of opportunities for fundamental research in the fields of surface science, optical and electronic properties of solid-state quantum systems and thermal transport through nanostructured materials. In this talk, after a general introduction on QDs and their basic structural properties, we will focus on two distinct topics and discuss their perspectives: (i) We will show how Ge dots embedded in a Si matrix can be used to efficiently scatter phonons (Fig. 1), producing a dramatic reduction of room-temperature thermal conductivity from ~150 to ~1.3 W m^{-1} K^{-1}, a value which is below that of amorphous Si and of the best (in the context of thermoelectrics) polycrystalline SiGe alloy reported so far; (ii) We will show how elastic stress can be effectively used not only for fabricating QDs, but also to tune their optical properties (light emission from excitons confined in InAs QDs in GaAs matrix) after growth.

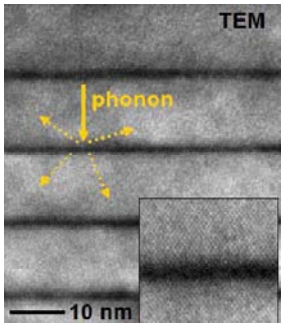

Fig. 1: Transmission electron microscopy image of Ge/Si layers with ultralow thermal conductivity

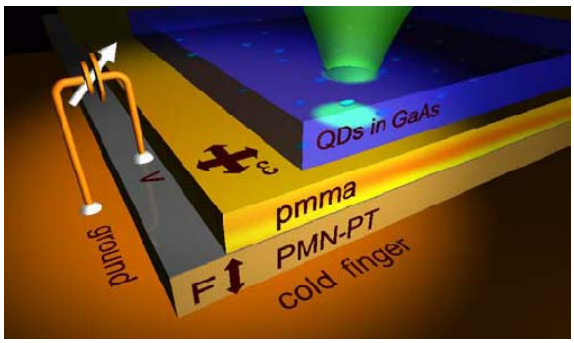

Fig. 2: Drawing of a piezoelectric-based device used to study the effect of external stress on InAs QDs embedded in a GaAs nanomembrane and engineer their emission properties

Alle Zuhörer sind ab 15:15 Uhr zum Kaffee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt Prof. Dr. Michael Hietschold, Tel. 0371/531-33203