MATERIALS DEPARTMENT / MRL
JOINT COLLOQUIUM

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"MBE growth of catalyst-free GaAs nanowires*"

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Abstract

Numerous concepts for fabrication of semiconductor quantum wires and quantum dots have been developed over the past 20 years. An important requirement for applications of such nanostructures in optically and electrically active devices is their high quality which often is only achieved by embedding them inside a crystalline matrix with low interface defect density. Self assembled semiconductor quantum dots and quantum wires have been used especially for optical and optoelectronic applications. I will discuss our recent approaches to achieve high quality quantum wires and hetero quantum wires using a high purity molecular beam epitaxy system and based on the GaAs/AlGaAs/InGaAs materials system. The growth is initiated by small Ga droplets at the surface of thin SiO_2 layers on (111)B GaAs substrates. Such novel and catalyst-free wires exhibit (110) side facets which can be overgrown under different growth conditions with arbitrary layer sequences like for example AlGaAs/GaAs/AlGaAs quantum well shell structures. Bright and clean photo luminescence is observed from the GaAs core and the quantum well coatings. Also remote doping of the shell structure is possible which results in high mobility electron systems in the GaAs core of the wires. Such high purity hetero-nanowires open many possibilities for novel electronic, optoelectronic and quantum devices for information technology and sensing.

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Reference:

Anna Fontcuberta i Morral et al., Appl. Phys. Letters **92**, 063112 (2008), and SMALL (in press)

Gerhard Abstreiter graduated from Technische Universität München (TUM) in physics in 1973 and received his doctoral degree in 1975. From 1975 until 1979 he worked as postdoc and staff scientist at Max Planck Institut für Festkörperforschung in Stuttgart and Grenoble. He returned to TUM Physics Department as group leader in 1979 and became full professor and director of the newly founded Walter Schottky Institut in 1987. His field of interest covers in general experimental semiconductor physics with special emphasis to structural, electronic and optical properties of nanostructures, molecular beam epitaxy for high purity hetero- and nanostructures, self-assembly and self-organisation of semiconductor quantum dots, and development of novel devices for nano-electronics, optoelectronics quantum information technology, and bio-sensing. He is author or co-author of more than 500 publications which have been cited more than 10000 times. He received several awards among which are Walter Schottky Prize (DPG), Gottfried Wilhelm Leibniz Prize (DFG), Max Born Prize and Medal (DPG and IOP) and von Schelling Prize (Bavarian Academy of Sciences). He became Fellow of the American Physical Society in1992 and was elected as Member of the Bavarian Academy of Science in 2007.

Host: Professor Chris Van de Walle