Electrical Engineering Seminar
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1 PM, Engineering Student Center

Host: Minjoo Larry Lee

Cross-sectional scanning tunneling microscopy: Studying compressively and tensile strained III-V semiconductor nanostructures

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The development of III-V based semiconductor devices has been concentrated during the last years on the compressively-strained material systems such as InAs layers in a GaAs(001), InP(001) or GaP(001) matrix. In order to understand the growth process of the resulting buried nanostructures cross-sectional scanning tunneling microscopy (XSTM) is a very powerful method.

This presentation gives a basic introduction to XSTM, its abilities and difficulties as well as an introduction to quantum-dot growth for optoelectronic devices. It will show the spatial parameters found for compressively-stained nanostructures within the different material systems, and discusses the differences and similarities of the resulting structures and the complexity of the nanostructure growth and formation process.

In contrast to the compressively-strained material systems recently investigated GaAs/GaSb(001) nanostructures may act as the model system for tensile-strained layers. It was found that they do not grow within the Stranski-Krastanov growth mode, but they form small agglomerations which are separated from each other by pure GaSb matrix material.

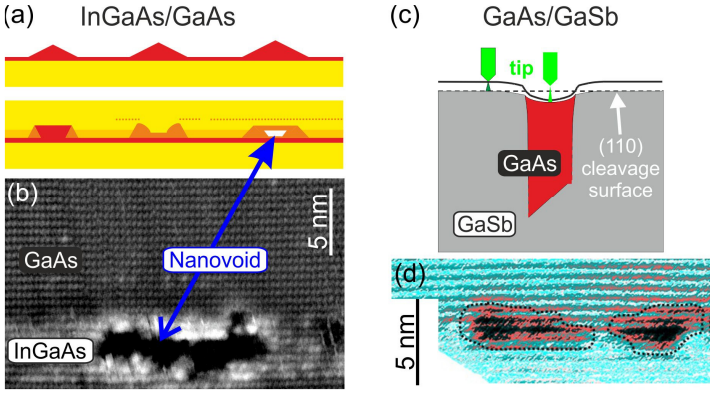

Fig. 1: (a) Model of InGaAs/GaAs quantum-dot capping including nanovoid formation, (b) atomically resolved XSTM image of a nanovoid, (c) sketch of XSTM at tensile-strained nanostructures, and (d) XSTM image of GaAs agglomerations (marked by dotted lines) in the GaSb matrix material.

Bio: Andrea Lenz is principal investigator at the Technische Universität Berlin, Germany supported by the German Research Foundation DFG. She received her Ph.D. degree in physics from the TU Berlin in 2008. Her research backgrounds are the structural and electronic properties of III-V semiconductor surfaces, interfaces and nanostructures as well as nitride semiconductors, which she studied with cross-sectional scanning tunneling microscopy and –spectroscopy. She received a student award in 2008 and a poster award in 2011. She has presented several invited talks at international conferences, workshops, and symposia and is the author or coauthor of a book chapter and of over 30 publications in international refereed journals.