

DS 18: Invited Holý

Time: Wednesday 9:30–10:15

Location: H2

Invited Talk

DS 18.1 Wed 9:30 H2

X-ray Scattering Investigations of Ge Quantum-dot Crystals Deposited on Prepatterned Si Substrates — •VACLAV HOLÝ¹, M. MIXA¹, J. STANGL², T. FROMHERZ², R. T. LECHNER², E. WINTERSBERGER², G. BAUER², CH. DAIS³, E. MÜLLER³, and D. GRÜTZMACHER³ — ¹Department of Condensed Matter Physics, Faculty of Mathematics and Physics, Charles University in Prague, Czech Republic — ²Institute for Semiconductor and Solid State Physics, Johannes Kepler University Linz, Austria — ³Laboratory for Micro- and Nanotechnology, Paul Scherrer Institut, Villigen, Switzerland

We used high-resolution X-ray diffractometry for the investigation of the structure of three-dimensional crystals of Ge quantum-dots grown

by a self-organization process during molecular-beam epitaxy of a periodic Ge/Si superlattice on a (001)Si substrate pre-patterned in two dimensions by extreme UV lithography and ion etching (lateral period below 100 nm). Due to a self-organization process driven by the propagation of internal strains from buried dots towards the growing surface, the dot ordering was almost perfectly replicated in all Ge layers in the multilayer stack, resulting in a three-dimensional tetragonal dot "supercrystal". From the reciprocal-space distribution of diffracted X-ray intensity we determined mean parameters of individual dots (shape, size, local chemical composition) and correlation properties of the dot positions. We modeled the self-organization process by a semi-atomic MonteCarlo model, yielding a correlation function of the dot positions that compares well with experimental data.