

## Nanospectroscopy on InAs Nanocrystals

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Spectromicroscopic measurements of InAs nanocrystals by soft x-ray photoemission electron microscopy (XPEEM) are presented. Measurements were performed with the spectroscopic photo emission and low energy electron microscope (SPELEEM) at beamline 6.2LL of ELETTRA in Trieste, Italy. The InAs nanocrystals were fabricated on Se-terminated GaAs(100) surfaces by molecular beam epitaxy (MBE) in Tsukuba, Japan. The samples were protected by an amorphous As capping layer deposited in-situ in the MBE chamber during transfer in air to ELETTRA. The capping layer was desorbed in the SPELEEM sample preparation chamber. Measurements on As-capping and decapping of InAs nanocrystals proved that the electronic properties of the samples were not changed by this procedure. A statistical analysis of nanocrystal density and size distribution was performed.

Integral photoelectron spectra measured with the SPELEEM are in good agreement with literature data. Chemical contrast in XPEEM images was readily obtained: XPEEM images measured at the photoelectron kinetic energy corresponding to the In 4d core level show the InAs nanocrystals brighter than the Se-terminated GaAs-substrate. The contrast is inverted at the energy of the Se 3d core level. Laterally resolved valence band spectra were obtained from stacks of XPEEM images. They clarify the band alignment between nanocrystals and substrate. Work function measurements on the nanocrystals indicate a dependence of work function on InAs overlayer thickness. Furthermore, the samples showed differences in the work function between nanocrystals and substrate. We suggest that Se out-diffusion onto the InAs nanocrystals might be the reason for these differences. Finally, laterally resolved core level spectra help to obtain a better understanding of the XPEEM images from the samples.