

Structural and Compositional Investigation of Semiconductor Quantum Materials

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The size, shape, strain distribution, compositional profile and spatial distribution are the critical factors determining the electronic level and thus the physical properties of semiconductor nano-structures. For those MBE-grown mesoscopic objects, lattice mismatch, surface segregation, interface diffusion and various kinetic effects make their formation mechanism very complicated. In fact, the structure and the formation mechanism of these self-assembled nano-structures are still not well understood. In this work, we applied grazing incidence X-ray scattering methods including reciprocal space map and small angle X-ray scattering to study the strain field, shape and spatial distribution of III-V semiconductor nano-structures. In particular, we will focus on the application of resonant X-ray scattering technique to accurately determine the compositional distribution within the nano-structures with high resolution.

Keywords: surface x-ray scattering, semiconductor epitaxy, nanostructures