Tailoring the structure and properties of the III-V nanostructures through an understanding of their growth mechanism

Gözde Tütüncüoğlu

ABSTRACT:

Semiconductor nanowires (NWs) & nanomembranes are of great interest since the last decade because of their advantages brought by their confined geometry, unique electrical and optical properties, and potential for future optoelectronic devices. The understanding of the growth mechanism of such III-V nanostructures would enable us to tailor their properties for novel optoelectronic applications.

In this talk, we present our results on III-V NWs and nanomembranes grown by Molecular Beam Epitaxy (MBE). The talk will start with the introduction of the growth mechanisms of self-catalyzed GaAs NWs and selective area epitaxy (SAE) GaAs nanomembranes and continue with the designed heterostructures based on them. It has been already shown for GaAs/AlGaAs core/shell NWs that the high degree of precision over the growth conditions offered by MBE and the lattice match of GaAs and AlGaAs enable us to obtain high quality heterostructures and such structures demonstrate unique optical properties. [1][2] While our research continues on GaAs/AlGaAs core/shell nanowires we have expanded our work to other geometries, GaAs membranes. GaAs nanomembranes have the potential to be defect-free when they are grown in a particular orientation, while twin defects, stacking faults and polytypism are more likely to occur in the case of NWs. Our ultimate purpose is to understand the effect of geometry and crystal structures of mentioned nanostructures on their optoelectronic properties. In this talk we will also show the ongoing studies on the crystallinity and latest results obtained from cathodoluminescence and photoluminescence studies to investigate the optical properties.

References:

[1]Anna Fontcuberta i Morral et al. Small 4 (7): 899–903. (2008)
[2]Heiss et al. Nature Materials 12, 439–444 (2013)