III-V Nanowires for Optoelectronic Device and Energy Applications

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Group III-V semiconductors have revolutionized electronics and optoelectronics due to their superior properties such as high carrier mobility, direct bandgap and band structure engineering capability. Reducing the device size to nanoscale brings many unique properties. In particular nanowires are anisotropic structures which have diameters of several to tens of nm's while their lengths could be µm's long. Thus they have a very high aspect ratio, large surface-area-to-volume ratio and allow carrier/photon confinement in two dimensions, which lead to their unique properties.

They are usually grown by the so-called vapour-liquid-solid mechanism, which relies on a metal nanoparticle to catalyze and seed the growth. An alternative technique to grow the nanowires is by selective area growth, where a dielectric mask is first patterned on the substrate prior to growth. Alternatively, nanowires can be fabricated from a top-down approach where nanoscale masks are used to form the nanowires during the etching process.

In this talk I will present and discuss the use of each of this technique to grow nanowires for optoelectronic device applications such as lasers, solar cells and electrodes for photoelectrochemical water splitting.