

MBE Growth of III-V Nanowires and Related Heterostructures – Application to Photovoltaics

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Nanowires are filamentary crystals with a diameter of few to a hundred of nanometers. Thanks to their dimensions they are the perfect playground for fundamental studies and for improving devices such as solar cells. Nanowires are typically obtained by the vapor-liquid-solid method in which a metal catalyst is used for the gathering of the precursor species and nanowire growth. In most of the cases gold is used, though it has been shown to affect negatively the electronic and optical properties of semiconductors. We obtain ultra-high purity GaAs nanowires by avoiding the use of gold and by the use of molecular beam epitaxy (MBE). MBE offers also the unique possibility of combining an extremely high purity of materials with the possibility of growing with epitaxial quality on the nanowire facets. Prismatic quantum wells and Stranski-Krastanov quantum dots are obtained with a very high quality, as demonstrated by the optical spectroscopy measurements. Finally, we discuss how these nanowires are excellent candidates for the fabrication of solar cells and high mobility transistors by using a modulation doped structure.