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Palladium assisted growth of InAs nanowires by Molecular Beam Epitaxy

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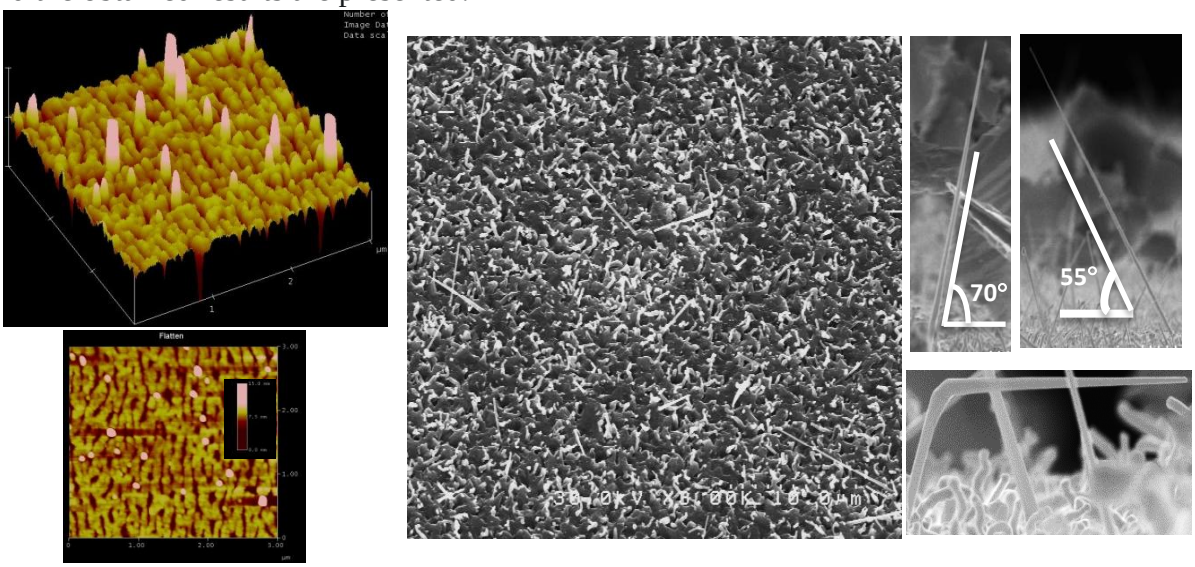
Abstract

One dimensional III-V semiconductor nanowires growth receives a great deal of attentions of their tuning crystal phases as well as orientations, depending on the growth parameters. We demonstrate the epitaxial growth of unusual non-<111> oriented InAs nanowires on As-terminated {111}B surface of GaAs substrates using a solid source molecular beam epitaxial technique. Palladium nanoparticles were exploited as catalyst material to assist the one dimensional crystal growth. The driving force for getting these different kinds of <11n> oriented nanowires is the excess surface free energy that arises due to the compressive strain at substrate/nanowire interface, alters the usual <111> growth directions [1]. The observed necking on the top of the grown nanowires clearly depicts that the growth adapts the Vapour-Liquid-Solid (VLS) growth mechanism. The degree of the inclined angles (~ 55° and 70° respectively) of the harvesting nanowires ensures that the grown nanowires are along <110> crystal orientations [2]. It was further strengthened by the obtained few Y and L shaped nanowires, which are the evidences of the altering different <110> growth directions by the growing nanowires themselves. Number of growth experiments were carried out to identify the appropriate growth conditions in order to obtain the reasonable density of the [110] oriented nanowires by changing the growth parameters such as temperature and V/III ratios respectively and the obtained results are presented.



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