Influence of Growth Parameters on Crystalline Quality of Selective-Area InAs/GaAs (111)B Nanowires Grown by Molecular Beam Epitaxy

Tyler J. Lindemann [1,2], Geoff C. Gardner [2,3], Sergei V. Gronin [2,3], Alex Webster [2], Raymond L. Kallaher [2,3] and Michael J. Manfra [1,2,3,4,5]

[1] *Department of Physics and Astronomy, Purdue University, West Lafayette, IN, USA*
[2] *Birck Nanotechnology Center, Purdue University, West Lafayette, IN, USA*
[3] *Microsoft Quantum at Station Q, Purdue University, West Lafayette, IN, USA*
[4] *School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, USA*
[5] *School of Materials Engineering, Purdue University, West Lafayette, IN, USA*

In the search for fault-tolerant quantum computing, many have turned their attention to topologically protected approaches, a promising technique being the braiding of Majorana fermions. Because the qubit state depends only upon topological invariants of the system, it is robust against decoherence [1]. It is predicted that semiconductor nanowires coupled to an *s*-wave superconductor will exhibit Majorana zero modes, making such a system a candidate for performing quantum computing operations [2]. One approach to creating scalable networks of semiconducting nanowires is selective-area growth (SAG) [3]. In SAG, nanowires can be epitaxially grown in lithographically defined openings on a dielectric mask. This approach also allows for *in-situ* growth of superconductors on the semiconducting wire, ensuring a clean semiconductor-superconductor interface. Various III-V substrates and nanowire materials are being investigated for this purpose [3,4].

The 3-fold symmetry of (111)B oriented substrates allows the construction of networks and devices with different geometries than those possible on 4-fold symmetric (100) oriented substrates. Faceting of the wires is also affected by substrate orientation, which could lead to vastly different transport characteristics. We examine the structural characteristics of InAs nanowires selectively grown on GaAs (111)B under various growth conditions. Previously, it has been shown that growth conditions determine selectivity windows [4]. Growth conditions also affect the final geometry and crystalline quality of nanowires. Structural characterization will be presented, including scanning electron microscopy, atomic force microscopy, and transmission electron microscopy data.

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