Epitaxy of the InAs/Al interface in MBE-grown semiconductor/superconductor heterostructures

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Among the binary III-V semiconductors InAs has a small band gap, large spin-orbit coupling, large *g*-factor and low electron effective mass. These properties make it an interesting material system to study quantum transport in mesoscopic systems and hybrid semiconductor /superconductor devices [1, 2]. A high carrier mobility and control over the surface/interface to a proximitizing superconductor, e.g. aluminum, is essential [3].

Here, we present a growth study of MBE-grown aluminum thin films on shallow InAs quantum wells [4]. The interface between the quantum well top barrier and in-situ deposited Al is studied in detail through TEM. By varying the material termination of the top barrier, we intentionally roughen the surface and thereby observe a reduced formation of grain boundaries in the subsequently deposited Al layer. We find that the intentional roughening does not impair the basic electronic properties of the semiconductor or the proximitized system. Finally, the found results are compared to a sample with a significantly increased top-barrier.

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