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Effects of carbon dopant on the morphology of GaAs nanowires

OMID SALEHZADEH, SIMON WATKINS, Simon Fraser University — Carbon is a well known dopant in the growth of planar III-V materials such as GaAs, however its use has not yet been investigated for nanowire growth by the vapor-solid-liquid growth mechanism. In this work we show that the morphology of gold catalyzed GaAs nanowires is significantly modified by the presence of CBr_4 vapor during growth by metalorganic vapor phase epitaxy (MOCVD). Nanowires grown in the presence of CBr_4 exhibit negligible tapering and much lower levels of Au catalyst migration than nanowires grown in the absence of CBr_4 under the same conditions. Increasing concentrations of CBr_4 lead to increased linear growth rate and reduced wire diameter. Nanowires grown with CBr_4 show no detectable stacking faults, in contrast to wires grown in the absence of CBr_4 which show a high density of stacking faults. We propose a simple model in which adsorbed carbon blocks the surface diffusion of Au down the wire. This work suggests a simple method to control the degree of tapering which should be applicable to other III-V materials. Preliminary Raman measurements indicate substantial red shifts in the lattice phonon modes with increasing carbon doping, indicating that carbon is actually incorporated into the nanowires.

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