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Growth and optical properties of silicon nanowires grown by vapor phase epitaxy SUN GON JUN, MSE Dept., MARK S. MILLER, MSE and ECE Depts., JUSTIN JACKSON, ECE Dept., University of Utah — We report on the growth and properties of silicon nanowires. The nanowhiskers were grown by vapor phase epitaxy (VPE) on Si (111) and (100) surfaces using gold as a catalyst, relying upon a vapor-liquid- solid mechanism. Most of the results we present here are for atmospheric pressure growth using either silicon tetrachloride or dilute silane in hydrogen, varying the temperature, concentration, and flow rate. The Au catalysts were created either by depositing thin Au layers of on Si, which break up into nano-scale droplets upon heating, or by electron beam lithography. The size and shape of these droplets play a large role in determining the resulting nanowire morphology. The silicon nanowires, observed by transmission electron microscopy and scanning electron microscopy, exhibit growth defects that include bending and kinking. The wire sizes ranged from 20 to 300 nm, with lengths from 100 nm to 20 μm, depending on catalyst size and growth conditions. TEM lattice images show the wire growth direction depends on wire size, with smaller wires growing in the [110] direction. Increasing the temperature leads to a broader distribution of wire widths and a faster growth rate. Optical properties include photoluminescence spectra, which show a strong peak near and below the silicon band edge, which may be explained by the axial strain.

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