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Three-dimensional nanoscale composition mapping of semiconductor nanowires.[1] LINCOLN LAUHON, DANIEL PEREA, JONATHAN ALLEN, STEVEN MAY, BRUCE WESSELS, DAVID SEIDMAN, Northwestern University — The composition of a single InAs nanowire was mapped in three dimensions with single-atom sensitivity and sub-nanometer resolution using local-electrode atom probe (LEAP) tomography. Arrays of epitaxial InAs nanowires were grown by chemical vapor deposition on GaAs substrates. Nanowires with diameters of 10-20 nm were analyzed over lengths of hundreds of nanometers. Three-dimensional reconstructions of the atoms in the nanowire showed hexagonal faceting, indicating that the LEAP analysis accurately reproduces the cross-section and shape of the nanowires. The Au catalyst particle sitting atop a nanowire was also analyzed; tomographic slices across the nanowire diameter, when displayed in 0.5 nm increments along the growth axis, revealed an extremely abrupt catalyst-nanowire interface that is also very flat. Despite the abruptness of the catalyst-nanowire interface, individual gold atoms were detected within the nanowire at a concentration of 100 ppm. These results indicate that LEAP microscopy can be used to (1) image buried nanowire interfaces in three dimensions and (2) analyze the concentration and distribution of dopant and impurity atoms in nanowires.

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