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Imaging the modified core structure of buried Bi nanolines[1] JIAMING SONG, BETHANY HUDAK, HUNTER SIMS, ANDREW LUPINI, PAUL SNIJDERS, Oak Ridge National Lab — Self-assembled, one-dimensional (1D) Bi nanolines on Si(100) surfaces are formed by two rows of surface Bi atoms supported by a "Haiku" core of reconstructed Si. These nanolines have been proposed as templates for atomic-scale wiring in nanoelectronics, or as sources of poorly soluble Bi dopants in Si films. Both applications require overgrowth of the nanolines to protect against oxidation. To understand the structure of the buried nanolines, high-resolution techniques are required. Here we employ scanning tunneling microscope (STM) and scanning transmission electron microscope (STEM) to probe Bi nanoline structures at the surface as well as at the interface with the capping layer. STM and STS data of the nanolines are consistent with the well-known Haiku core structural model. However, using high-resolution STEM we show that after depositing a Si capping layer, a modified Si core can survive depending on capping-layer growth temperature, but the Bi atoms diffuse away from their original position. The resulting 1D Si nanostructures, buried in semiconducting Si, may offer a useful nanoelectronic platform to address dopant qubits. The combination of high resolution STM and STEM provides new opportunities to guide the design of atomic-scale functional materials.

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