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Growth peculiarities during vapor-liquid-solid growth of silicon nanowhiskers by electron-beam evaporation

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Abstract

One-dimensional (1D) silicon (Si) nanostructures were grown by electron-beam evaporation catalyzed by gold nanoparticles on silicon substrates following the vapor-liquid-solid growth mechanism. We report three strikingly different growth morphologies of the 1D Si nanostructures and discuss their formation. The morphology of the silicon nanostructures strongly depends on gold layer thickness, annealing temperature before deposition and growth temperature during the deposition. The formation of nanoscale silicon features such as nanobelts, nanowires and nanowhiskers was observed. The nanoscale silicon features were characterized by transmission and scanning electron microscopy using imaging, diffraction and energy-dispersive X-ray spectroscopy, atomic force microscopy and UV micro-Raman spectroscopy. © Springer-Verlag 2006.