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Modeling Earle-Stage Kinking during VLS Ge Nanowire Growth SEUNGHWA RYU, Mechanical Engineering, Stanford University, Stanford, CA, United States, YANYING LI, Applied Physics, Stanford University, Stanford, CA, United State, ANN F. MARSHALL, Geballe Laboratory for Advanced Materials, Stanford University, Stanford, CA, United State, WEI CAI, Mechanical Engineering, Stanford University, Stanford, CA, United State, PAUL C. MCINTYRE, Materials Science Engineering, Stanford University, Stanford, CA, United State — The catalyzed growth of Ge nanowires from gold nanoparticles via the vapor-liquid-solid (VLS) mechanism has been the subject of intense research worldwide, due to their potential applications in nanotechnology. Understanding the fundamental mechanisms underlying kinking during Ge nanowire growth, especially at the early-stage, is helpful for better control of Ge nanowire growth for technological applications. We report an investigation of wire morphology before and during Ge nanowire kinking in early stage growth under typical nucleation conditions. The Ge nanowires grew either along the vertical [111] direction or kinked away onto inclined <111> axes early on during their growth. We found that most kinked Ge nanowire deposited under these conditions kinked at similar height, and had similar sidewall facet structure in the kinked region. High-resolution transmission and scanning electron microscopy investigations also showed that the typical kinking-structure was bounded by (111) and other relatively stable Ge surface facets. We construct 3D phase field model of the nanowire based on the transmission and scanning electron microscopy and compare the evolution of the droplet and nanowire with experimental observations.

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