TITLE: Environmental Electron Microscopy Study of the Nucleation and Growth of Si and Ge Nanowires

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ABSTRACT: Silicon and germanium nanowires could be important constituents of future nano-electronic devices. These applications require greater control of the growth process and if possible the use of catalysis other than gold. We present a video-rate environmental transmission electron microscopy study of Si nanowire nucleation from Pd [1] and Ni under disilane exposure. The Pd and Ni catalyst films form silicide particles, which remain solid during nanowire nucleation and growth. A Si crystal nucleus forms by phase separation, as observed for the liquid Au–Si system, which we use as a comparative benchmark. The dominant coherent Pd silicide/Si growth interface subsequently advances by lateral propagation of ledges, driven by catalytic dissociation of disilane and coupled Pd and Si diffusion. We compare these catalyst interface dynamics to Ge nanowire growth from digermane.

[1] S Hofmann et al, Nature Materials 7, 372 (2008)