359b Self-Catalytic Growth of Gan Nanowires

Eric A. Stach, Peter Pauzauskie, Tevye Kuykendall, Joshua Goldberger, and Peidong Yang

Abstract:

Crucial to nanotechnology is the creation of nanoscale building blocks of various sizes and shapes.[1] Nanostructures of wide band-gap gallium nitride are of particular interest because of their applications in short-wavelength optoelectronic devices and high- that can be used as high mobility field effect transistors as well as miniaturized UV-blue nanolasers.[2,3] The synthesis of GaN nanowires via the vapor-liquid-solid (VLS) process*4* commonly relies on transition metal clusters such as Ni, Fe and Co, which inevitably results in undesired contamination within the otherwise single crystalline nanowires. Here we report real-time transmission electron microscopy (TEM) observations of the growth of GaN nanowires via a self-catalytic VLS mechanism. These nanowires nucleate and grow from Ga droplets formed during thermal decomposition of GaN at elevated temperatures in vacuum. This is the first direct observation of self-catalytic growth of nanowires via the VLS mechanism, and suggests new strategies for growth of semiconductor nanowires without unintentional doping.

This work was supported by the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

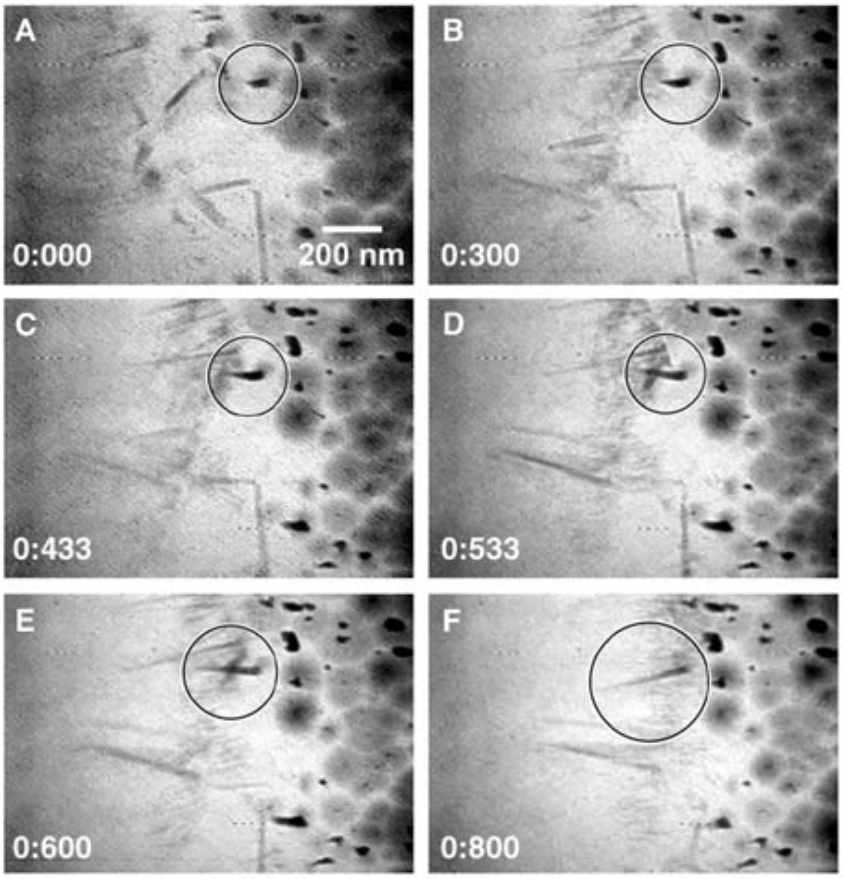

Figure 1 A series of video frames grabbed from observations of GaN decomposition at È 1050 ^{o}C, showing the real-time GaN nanowire growth process. The number on the bottom left corner of each frame is the time (second: millisecond).

1 Wu, Y.; Fan, R.; Yang, P. *Int. J. Nano.* **2002**, *1*,1-39.

2 Huang, Y.; Duan, X.; Cui, Y.; Lieber, C. M. *Nano Lett*. **2002**, *2*, 101.

3 Johnson, J.; Choi, H.; Yang, P.; Saykally, R. *Nature Mater*. **2002**, *1*, 101.

4 Duan, X.; Lieber, C. M. *J. Am. Chem. Soc*. **2000**, *122*, 188.