319d Nucleation and Growth Mechanisms in "Self-Catalysis" Schemes for Nanowire Synthesis: Indium Nitride

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Indium nitride (InN) nanowire synthesis using indium vapor transport in dissociated ammonia environment (reactive vapor transport) is studied in detail to understand the nucleation and growth mechanisms involved with the so-called "self-catalysis" schemes. The results show that InN crystal nucleation occurs first, followed by selective formation of indium droplets on top of crystals. The 1-D nanowire growth takes place through liquid phase epitaxy with underlying InN crystals. These details about the nucleation and growth aspects within these self-catalysis schemes are further rationalized by demonstrating the growth of heteroepitaxial arrays and "tree-like" morphologies. In contrast, the direct nitridation of indium droplets under similar conditions led to multiple nucleation and basal growth of nanowires without any indium droplets at tips in the initial stages. Electrical and optical characterization of the synthesized nanowires, performed to determine the bandgap of InN, will be discussed.