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Size Control over Nanocrystalline Gallium Nitride Using Nonequilibrium Plasma Aerotaxy DILLON MOHER, NECIP UNER, ELIJAH THIMSEN, Washington University, St. Louis — GaN is a semiconductor (SC) of interest due to its wide direct bulk band gap, high stability in many chemical environments, high breakdown voltage, non-toxicity, and high refractive index. We have recently developed a new gas-phase process for the synthesis of free-standing and high-quality III-V SC nanocrystals (NCs) termed nonequilibrium plasma aerotaxy (NPA). For GaN, NPA uses only a gallium source aerosol, nitrogen, and argon in a low-temperature, low-pressure flow through plasma. NC size control has been demonstrated in the range of 5 to 45 nm. Current work seeks to extend control to both smaller and larger size ranges. Particles smaller than 7 nm exhibit size-dependent photoluminescence, emitting in the UVC range, and particles larger than 100 nm can have strong interaction with light for various photonic applications. A combination of approaches was used to make particles larger including manipulating the feed gas composition, increasing the residence time, and pulsing a secondary plasma to cause growth. A secondary mode in the size distribution has evolved which contains a significant fraction of the product mass and is in the size range 75 to 150 nm. The stoichiometry of the large particles and the prospect for making them monodispersed and even larger will be discussed.

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