Structural properties of GaN nanowires and correlation to their functional properties

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In this study we will show how Cs-probe aberration corrected STEM, CBED and associated techniques give striking methods to correlate the structural properties to the functional properties of GaN nanowires (NWs) obtained by molecular beam epitaxy. The polarity of the GaN NWs is determined by CBED. We propose that the particular nucleation mechanism is responsible for their N-polarity. The growth kinetics is investigated using AlN thin layers as time markers. The STEM-HAADF allows revealing very thin AlN markers. Finally AlN/GaN core-shell structures are quantitatively characterized using GPA on STEM-BF and HAADF images. These measurements on individual nanowires are compared to measurements obtained on assemblies of NWs by high resolution X-Ray diffraction (HRXRD) and grazing incidence X-Ray diffraction (GIXRD). Correlation between the single NW micro-photoluminescence and the NW structure analyzed by the HRSTEM established for several NWs allowed us to directly relate the emission blueshift to the core and shell thicknesses.