Electronic Supplementary Material (ESI) for Nanoscale.

Homogeneous and well-aligned GaN nanowire array via a modified HVPE process and their cathodoluminescence properties

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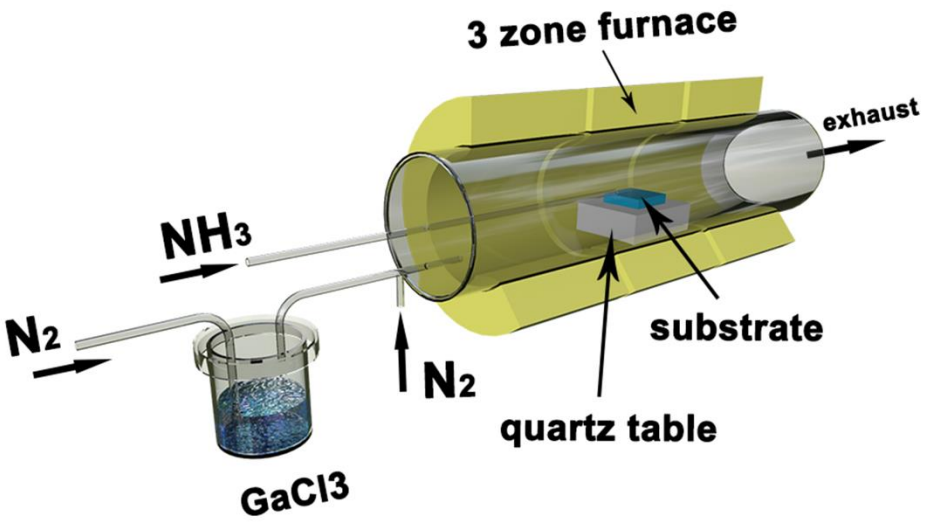

Fig. S1 Schematic diagram of the home-made modified HVPE gas pipeline and reactor.

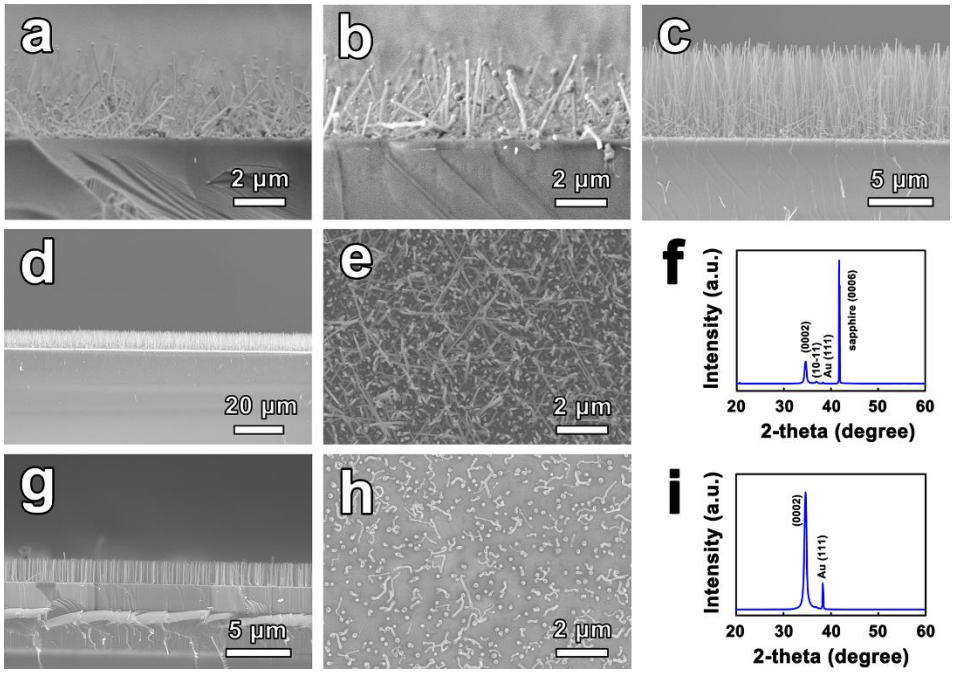

Fig. S2 SEM images of GaN nanowires grown on c-sapphire substrate with NH_3 flow rate of (a) 50 sccm, (b) 25 sccm and (c) 15 sccm, respectively. Side- and top-view SEM images and corresponding XRD patterns of GaN nanoarrays grown on c-sapphire for 30 min (d-f) and c-GaN/sapphire substrate for 15 min (g-i) with NH_3 flow rate of 10 sccm.

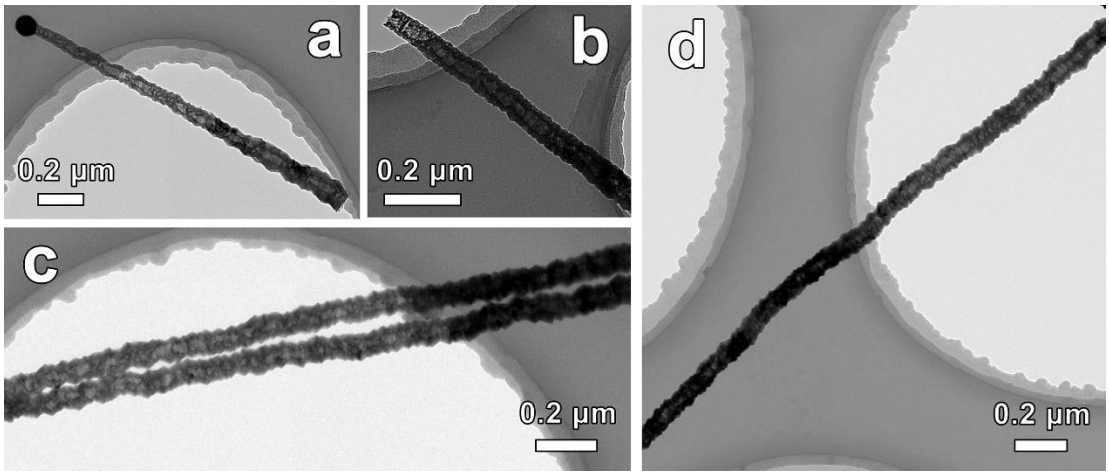

Fig. S3 Low-magnification TEM images of [0001]-oriented GaN nanowires grown by modified HVPE technique for (a, b) 5 min and (c, d) 30 min.

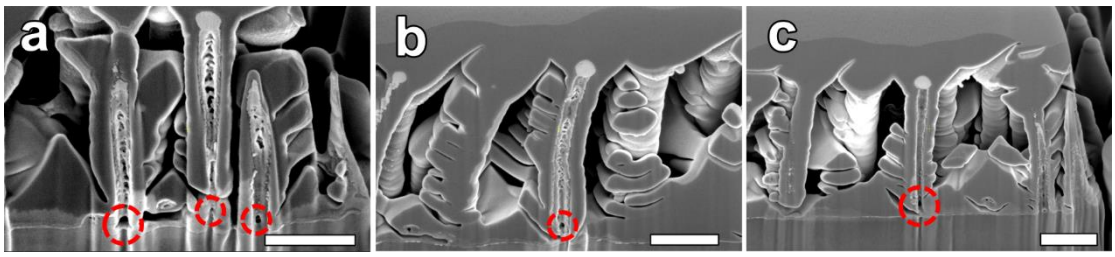

Fig. S4 SEM images of the longitudinal section sample of the vertically epitaxial GaN nanowires prepared by FIB technique in the double beam xenon ion microscope system (Scale bar = 1 μm).

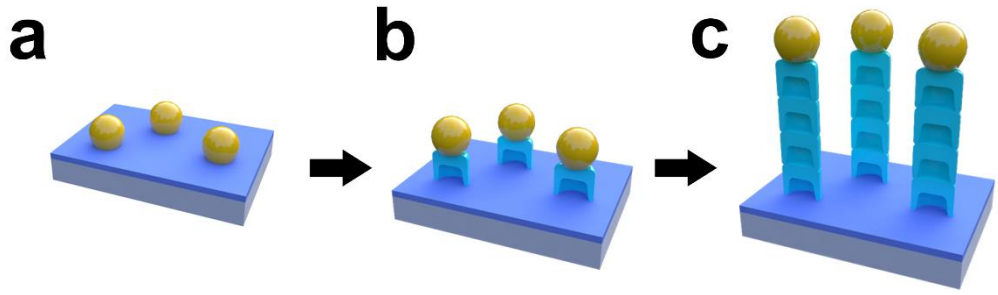

Fig. S5 Schematic illustration describing the growth mechanism of bamboo-like hollow GaN nanowire arrays: (a) the formation of Au-Ga alloy particles; (b) initial nucleation of the hollow GaN nuclei and (c) subsequent growth of vertical GaN nanowire array with discontinuous hollow structure.

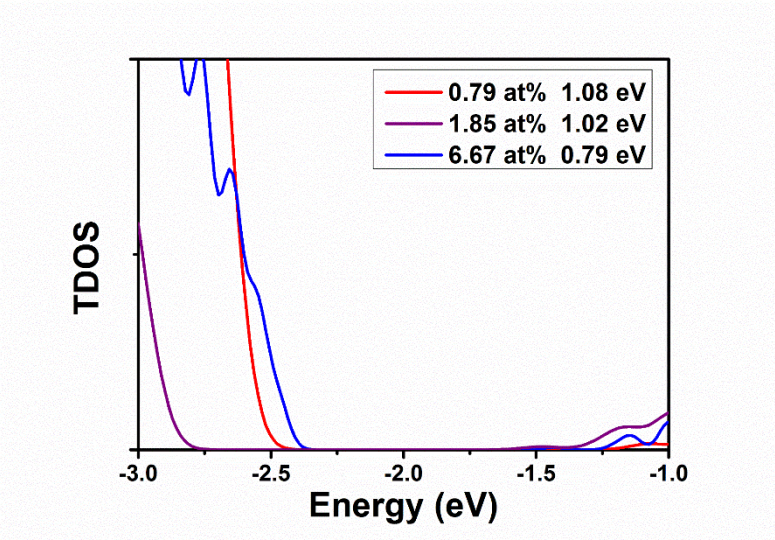

Fig. S6 Total density of states and calculated bandgaps of Cl-doped GaN with Cl doping density of 0.79 at%, 1.85 at% and 6.67 at%.