Pulsed Growth Of GaN Nanowires And Applications In Group III Nitride Semiconductor Substrate Materials And Devices

Abstract

Exemplary embodiments provide semiconductor devices including high-quality (i.e., defect free) group III-N nanowires and uniform group III-N nanowire arrays as well as their scalable processes for manufacturing, where the position, orientation, cross-sectional features, length and the crystallinity of each nanowire can be precisely controlled. A pulsed growth mode can be used to fabricate the disclosed group III-N nanowires and/or nanowire arrays providing a uniform length of about 10 nm to about 1000 microns with constant cross-sectional features including an exemplary diameter of about 10- 1000 nm. In addition, high-quality GaN substrate structures can be formed by coalescing the plurality of GaN nanowires and/or nanowire arrays to facilitate the fabrication of visible LEDs and lasers. Furthermore, core-shell nanowire/MQW active structures can be formed by a core-shell growth on the nonpolar sidewalls of each nanowire.

FIG. 2