

Fabrication of Vertically Aligned GaN Nanostructures and Their Field Emission Property

조종희, 김제형, 조용훈

KAIST 물리학과

The field emission properties of GaN are reported in the present study. To be a good field emitter, it requires a low work function, high aspect ratio, and strong mechanical stability. In the case of GaN, it has a quite low work function (4.1eV) and strong chemical/mechanical/thermal stabilities. However, so far, it was difficult to fabricate vertical GaN nanostructures with a high aspect ratio. In this study, we successfully achieved vertically well aligned GaN nanostructures with chemical vapor-phase etching methods [1] (Fig. 1). In this method, we chemically etched the GaN film using hydrogen chloride and ammonia gases at high temperature around 900°C. This process effectively forms vertical nanostructures without patterning procedure. This favorable shape of GaN nanostructures for electron emitting results in excellent field emission properties such as a low turn-on field and long term stability. In addition, we observed a uniform fluorescence image from a phosphor film attached at the anode part. The turn-on field for the GaN nanostructures is found to be about 0.8 V/ μ m at current density of 20 μ A/cm². This value is even lower than that of typical carbon nanotubes (1 V/ μ m). Moreover, threshold field is 1.8 V/ μ m at current density of 1 mA/cm². The GaN nanostructures achieved a high current density within a small applied field range. We believe that our chemically etched vertical nanostructures are the promising structures for various field emitting devices.

Keywords: GaN, field emitter, field emission

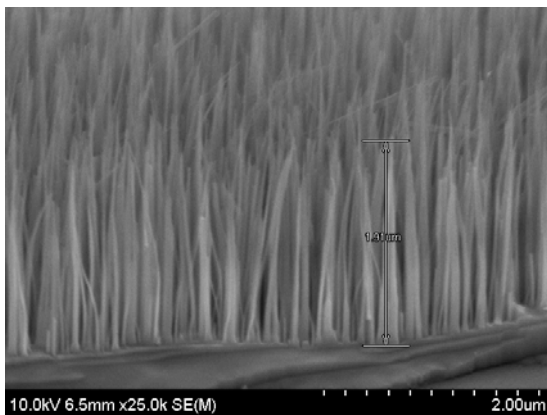


Fig. 1.



Fig. 2.