

Structural and Optical Properties of Monoclinic Ga₂O₃ Nanowires Synthesized by Arc Discharge

Young Chul Choi[1], Won Seok Kim[1], Seung Mi Lee[1], Dong Jae Bae[1], Young Hee Lee [1,2], Gyeong-Su Park[3], Won Bong Choi[3], Nae Sung Lee [3], and Jong Min Kim [3]

[1] Dept. of Semiconductor Science and Technology and Semiconductor Physics Research Center, Jeonbuk National University, Jeonju 561-756, Korea

[2] Dept. of Physics, Jeonbuk National University, Jeonju 561-756, Korea

[3] Samsung Advanced Institute of Technology, Suwon 440-600, Korea

Monoclinic gallium oxide nanowires were catalytically synthesized by electric arc discharge of GaN powders mixed with a small amount (less than 5 %) of transition metals under a pressure of 500 torr (80 %-Ar + 20. %-O₂). SEM and high-resolution (HR) TEM images showed that the average diameter of the wires was about 30 nm and their lengths were as long as up to one hundred micrometer, resulting in extremely large aspect ratio. Fourier diffractogram was indicative of single crystalline nature of the monoclinic Ga₂O₃ wire. HRTEM images also showed twin defects at the center of the wire, which might play as nucleation seeds. Both MC-XRD pattern and FT-Raman spectrum of the wires identified the observed nanowires as monoclinic crystalline gallium oxides. Density functional calculations represent that monoclinic Ga₂O₃ has an indirect band gap. It was found from the UV absorption spectrum that monoclinic-Ga₂O₃ has an indirect band gap of 3.6 eV.