The synthesis of Mg-doped ZnO nanowire and electrical properties of polymer passivated n-ZnO nanowire field effect transistors (FETs)

박용규, 김상훈, 이은원, 한윤봉*
전북대학교
(ybhahn@chonbuk.ac.kr*)

Mg-doped ZnO nanowires with a Mg content of 0.3~0.5 atom % were synthesized on p-type Si substrate by the thermal evaporation process of metallic zinc and magnesium powder in the presence of oxygen without the use of any catalyst or additives. The detailed structural and optical properties revealed that the grown nanowires are single-crystalline with the wurtzite hexagonal phase grown along the [0001] direction and possessing a good optical properties. The electrical transport properties of the as-grown nanowires was explored by fabricating the field effect transistors (FETs) using a single ZnO nanowire. To investigate the passivation effects on the electrical properties of the as-grown nanowires, the single nanowire based FETs were passivated with polymethyl methacrylate (PMMA) layer. From the detailed electrical properties it was confirmed that the passivated nanowires based FETs exhibited much higher carrier concentration (~5.2 x 1017 cm-3) and field effect mobility (~55 cm2/Vs) as compared to non-passivated nanowires based FETs which show less carrier concentration (~9.3 x 1017 cm-3) and field effect mobility (~89 cm2/Vs) due to reduction in physically adsorbed OH or oxygen molecules in the passivated ZnO nanowire FETs.