

## Solution Processed p-type Doping in ZnO Nanoparticles and Its Inkjet-Printing Application

Mohammad Vaseem, 홍아라, Muhammad Yasir, 박용규,  
노원엽, 한윤봉\*  
전북대학교 화학공학부  
(ybhahn@jbnu.ac.kr\*)

ZnO has demonstrated a possibility to be doped as a p-type by using group-*I* and group-*V* elements. Moreover, for highly efficient optoelectronic devices, it is essential to produce high-quality p-type ZnO. To date, enormous efforts have been dedicated to produce p-type ZnO mainly using gas-phase synthesis method. Herein, we report a simple, reliable, and low-cost method for growing and doping p-type ZnO nanoparticles in aqueous solution process using Li, Na and K as a dopant. As-synthesized p-ZnO nanoparticles were further formulated as an ink using mixed solvents. The electrical characterization of ZnO nanoparticles were examined by fabricating field effect transistors (FETs) in which ZnO line were directly inkjet-printed between source and drain electrodes on Si/SiO<sub>2</sub> (gate) substrate. Notably, current versus drain voltage ( $I_{ds} - V_{ds}$ ) characteristics and  $I_{ds} - V_{gt}$  curve which shows higher current measured at negative gate voltage, which further confirmed p-type semiconductivity of ZnO printed features.