

Ultra-sensitive VOCs detection of high-resolution CuO/Cu₂O/Ag nanopattern sensor최윤미^{1,2}, 조수연^{2,3}, 김종혁¹, 정희태^{2,3,†}¹한국화학연구원; ²한국과학기술원; ³나노융합연구소(heetae@kaist.ac.kr[†])

Ultra-sensitive VOC gas sensors have been developed for real life applications such as early disease diagnoses, atmospheric monitoring system in automobiles and industries. This study significantly improved the VOCs detection performance of the p-type copper oxide sensors by incorporating Ag nanoparticles. The Ag nanoparticles decorated high-resolution p-type CuO/Cu₂O nanopattern channels (CuO/Cu₂O/Ag) were fabricated via unique lithographic methods. The gas response ($\Delta R/R_a$) of CuO/Cu₂O/Ag sensor noticeably improved toward all VOCs compared with the pristine CuO/Cu₂O gas sensor (2.9, 4.0, 6.2, 7.7 and 7.3 increment at 1 ppm toluene, ammonia, ethanol, propanal and acetone). The sensor also worked well in the wide range of acetone concentration from 125 ppb to 1000 ppm, and showed high gas sensitivity ($\Delta R/R_a = 8.0$ at 0.125 ppb and 34 at 1000 ppm) as well as fast recovery time (37.9s at 1000ppm). The ultra-high performance of CuO/Cu₂O/Ag gas sensor could be attributed to unique morphological property (high resolution (~30nm), high-aspect-ratio (~12) and ultra-small grain boundaries (~5nm)) and electronic and chemical sensitizations of Ag dopants.