ZnO 나노선 - Au 나노입자 하이브리드 메모리 소자

김상식, 염동혁, 강정민, 윤창준, 박병준, 김기현, 정동영, 김미현*, 고의관*
고려대학교, *한국기초과학지원연구원

A ZnO nanowire - Au nanoparticle hybrid memory device

Sangsig Kim, Donghyuk Yeom, Jeongmin Kang, Changjoon Yoon, Byoungjun Park, Kihyun Keem, Dong-Yuong Jeong, Mihyun Kim*, Eui Kwan Koh*
Korea Univ. *Korea Basic Science Institute

Abstract : Nanowire-based field-effect transistors (FETs) decorated with nanoparticles have been greatly paid attention as nonvolatile memory devices of next generation due to their excellent transportation ability of charge carriers in the channel and outstanding capability of charge trapping in the floating gate. In this work, top-gate single ZnO nanowire-based FETs with and without Au nanoparticles were fabricated and their memory effects were characterized. Using thermal evaporation and rapid thermal annealing processes, Au nanoparticles were formed on an Al_2O_3 layer which was semi cylindrically coated on a single ZnO nanowire. The family of I_{DS}-V_{GS} curves for the double sweep of the gate voltage at V_{DS} = 1 V was obtained. The device decorated with nanoparticles shows giant hysterisis loops with $\triangle V_{th}$ = 2 V, indicating a significant charge storage effect. Note that the hysterisis loops are clockwise which result from the tunneling of the charge carriers from the nanowire into the nanoparticles. On the other hand, the device without nanoparticles shows a negligible countclockwise hysterisis loop which reveals that the influence of oxide trap charges or mobile ions is negligible. Therefore, the charge storage effect mainly comes from the nanoparticles decorated on the nanowire, which obviously demonstrates that the top-gate single ZnO nanowire-based FETs decorated with Au nanoparticles are the good candidate for the application in the nonvolatile memory devices of next generation.

Key Words : ZnO, nanowire, Au, nanoparticle, hybrid, memory