TTP-042

Improvement in the bias stability of zinc oxide thin-film transistors using an O_2 plasma-treated silicon nitride insulator

김웅선, 문연건, 권태석, 박종완

한양대학교 신소재공학과

Thin film transistors (TFTs) based on oxide semiconductors have emerged as a promising technology, particularly for active-matrix TFT-based backplanes. Currently, an amorphous oxide semiconductor, such as InGaZnO, has been adopted as the channel layer due to its higher electron mobility. However, accurate and repeatable control of this complex material in mass production is not easy. Therefore, simpler polycrystalline materials, such as ZnO and SnO_2, remain possible candidates as the channel layer. Inparticular, ZnO-based TFTs have attracted considerable attention, because of their superior properties that include wide bandgap (3.37eV), transparency, and high field effect mobility when compared with conventional amorphous silicon and polycrystalline silicon TFTs. There are some technical challenges to overcome to achieve manufacturability of ZnO-based TFTs. One of the problems, the stability of ZnO-based TFTs, is as yet unsolved since ZnO-based TFTs usually contain defects in the ZnO channel layer and deep level defects in the channel/dielectric interface that cause problems in device operation.

The quality of the interface between the channel and dielectric plays a crucial role in transistor performance, and several insulators have been reported that reduce the number of defects in the channel and the interfacial charge trap defects. Additionally, ZnO TFTs using a high quality interface fabricated by a two step atomic layer deposition (ALD) process showed improvement in device performance

In this study, we report the fabrication of high performance ZnO TFTs with a Si_3N_4 gate insulator treated using plasma. The interface treatment using electron cyclotron resonance (ECR) O_2 plasma improves the interface quality by lowering the interface trap density. This process can be easily adapted for industrial applications because the device structure and fabrication process in this paper are compatible with those of a-Si TFTs.