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Influence of in-situ remote plasma treatment on characteristics of amorphous indium gallium zinc oxide thin film-based transistors

강태성, 구자현, 홍진표*

한양대학교 물리학과

The amorphous indium-gallium-zinc-oxide (a-IGZO) materials for use in high performance display research fields are strongly investigated due to its good performance, such as high mobility and better transparency. However, the stability of a-IGZO materials is increasingly becoming one of critical issues due to the sub-gap electron trap sites induced by rough interfaces during deposition processing. It is well-known that the threshold voltage shift is related to interface roughness and oxygen vacancy formed by breaking weak chemical bonds. Here, we report the better properties of transparent oxide transistors by reducing the threshold voltage shift with an external rf plasma supported magnetron sputtering system. Mainly, our sputtering method causes the surface of sample to be sleek, so that it prevents the formation of various defects, such as shallow electron trap sites in the interface. External rf power was applied from 0 to 50W during RF sputtering process to enhance the stability of our oxide transistor without having a large voltage shift. To observe the effects of external rf-plasma source on the properties of our devices, Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM) are carried out to observe surface roughness and morphology of sputtered thin film. In addition, typical electrical properties, such as I-V characteristics are analyzed.

Keywords: a-IGZO