스퍼터링 공정으로 제작된 비정질 산화물 박막트랜지스터의 하프늄 금속이온 영향

Role of Hf in amorphous oxide thin film transistors fabricated by rf-magnetron sputtering

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Abstract : Time dependence of the shift of the threshold voltage of amorphous hafnium-indium-zinc oxide (a-HIZO) has been reported under on-current stress condition. a-HIZO thin films were deposited on SiO_2/Si (100) by rf magnetron sputtering. XPS measurement indicates that the *Hf* metal cations in a-HIZO system after annealing process reduce oxygen vacancies by binding oxygen. It was found that the *Hf* metal cation can be effectively incorporated in the IZO thin films as a suppressor against both the oxygen deficiencies and the carrier generation in the ZnO-based system.

Key Words : a-HIZO, Oxide TFT, suppressor, transistor, threshold voltage

1. Introduction

An amorphous oxide semiconductor (AOS) is of great interest for the applications in mobile electronics, optoelectronics, and future displays.[1] In particular, the high stability of AOS-TFTs that can be improved by using proper materials and optimizing the process has drawn a lot of attention for future active channel layer.[1-5]

2. Results and Discussion

The XPS spectra of a-HIZO films as-deposited and post-annealed at 350°C in N_2 environment. the binding energy of Hf 4f shifted to a higher energy level after annealing, which indicated that the binding energy with oxygen is increased. Also, the intensity and the peak of O 1s is increased and shifted to lower binding energy level from 531 eV to 529.5 eV after thermal annealing, which is well agreed with the reduction of oxygen vacancy due to Hf metal cations as shown in Fig. 1. A little shift of the threshold voltage has been observed by a bias stress (BS) test for 60 h. The Hf cations in a-HIZO TFTs is a way of providing higher stability and reducing V_{th} shift under long time bias stress in an air environment.

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