

RF magnetron sputtering 방식을 이용하여 직접 증착된 HfO₂ flim의 열처리에 따른 구조 및 전기적 특성에 관한 연구

이을택, 김병균, 박재경, 정석원, 노용한

성균관대학교 정보통신공학부

The development of reliable gate oxides is an important issue for TFT research. Specifically, gate oxides grown have to exhibit good electrical and physical properties such as low leakage current, low interface trap density, and minimum value of hysteresis window.

Hafnium oxide (HfO₂) film was directly deposited by RF magnetron sputtering method at room temperature on silicon. HfO₂ film was annealed by rapid thermal process (RTP) at 300°C~600°C in N₂ ambient during 1 minute. Increasing annealing temperature, electrical properties of HfO₂ film was improved also flat band voltage changing from -3.49 to 0.85. The capacitance - voltage hysteresis state was suppressed drastically after high-temperature annealing. It shows that increasing annealing temperature fixed oxide charge density. But after annealing process at 600°C, leakage current density and capacitance of HfO₂ film was reduced that the reason is crystallization phenomenon. It is also indicated by transmission electron microscope (TEM) and X-ray diffraction .TEM image demonstrated that interfacial layer was increased with high-temperature annealing. This phenomenon shows that high temperature annealing mainly causes the thickness increase of HfO₂ film during the RTP.

Directly deposited method reduced HfO₂ film process step. It also improved electrical properties and fixed oxide charge density. HfO₂ film shows low value of hysteresis window. Result indicated that directly deposited HfO₂ films must be considered as one of candidates for gate insulator in TFTs.