

NDRO형 FeRAM용 MeFIS와 MeFINS 구조의 게이트 캐퍼시터 특성
(Characteristics of Pt/SBT/Ta₂O₅/Si (MFIS) and Pt/SBT/Ta₂O₅/SiN_x/Si
(MFINS) Structure Gate Capacitors for NDRO type FeRAM Applications)

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Recently, a metal-ferroelectric-semiconductor field effect transistor (MFSFET), where ferroelectric materials are used as gate insulators, has brought about much attention for memory application. However, it is still difficult to obtain a good quality ferroelectric layer on the Si surface and reduce the interface trap density between the ferroelectric thin film and the Si. Therefore, it has been proposed to introduce an insulator between Si and ferroelectric layer. To avoid undesirable inter diffusion between Si and SBT, we used an ultra-thin silicon nitride layer to serve as a buffer between Si and SBT. This silicon nitride buffer layer was immersed active nitrogen ions into Si substrate with ICP (Inductive-Coupled-Plasma). In this study, we have compared Pt/SBT/Ta₂O₅/Si (MeFIS) with Pt/SBT/Ta₂O₅/SiN_x/Si (MeFINS).

To fabricate the Pt/SBT/Ta₂O₅/Si structure, Ta₂O₅ films were deposited on n-type (100) Si wafer by rf-sputtering of Ta target in the reactive oxygen ambient. SBT films were prepared by sol-gel method on Ta₂O₅/Si substrate and annealed at 800°C for 1 hour in oxygen atmosphere. A top Pt electrode of 2x10⁴cm² diameters was deposited using dc-sputtering. In order to obtain good substrate contact, we applied HF to remove the backside oxide of the Si wafer. A pure Cu foil was attached with silver paste.

The crystalline of Ta₂O₅/Si, Ta₂O₅/SiN_x/Si, SBT/Ta₂O₅/Si and SBT/Ta₂O₅/ SiN_x/Si structures were characterized by X-ray diffraction (XRD) measurement. The MFIS capacitors were investigated C-V characteristics and leakage current. Interactions between SBT, insulator and Si were also investigated by using Auger Electron Spectroscopy.