

# Characteristics of Single Transistor type Ferroelectric Memory Using Pt/SrBi<sub>2</sub>Ta<sub>2</sub>O<sub>9</sub>/Si and Pt/SrBi<sub>2</sub>Ta<sub>2</sub>O<sub>9</sub>/Y<sub>2</sub>O<sub>3</sub>/Si Gate Structure

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## Abstract

A metal ferroelectric semiconductor and metal ferroelectric insulator semiconductor field effect transistor (MFS/MFISFET) for the memory applications were fabricated and the effects of a buffer insulator were investigated by comparing their characteristics. The SrBi<sub>2</sub>Ta<sub>2</sub>O<sub>9</sub> (SBT) film was used as a ferroelectric gate material and the Y<sub>2</sub>O<sub>3</sub> thin film was used as the buffer insulator. Dry etching process using an inductively coupled plasma reactive ion etching (ICP-RIE) process was developed and adapted to remove the useless electrode and ferroelectric film except for the gate regions in the fabrication of MFSFET and MFISFET. The etch rate and the vertical profile were investigated with various gas mixture. The etch rate of 995 /min and the vertical etch profile of 75 degree of SBT film were obtained with the 10:10:1 gas mixture of Ar:Cl<sub>2</sub>:C<sub>4</sub>F<sub>8</sub>. For the comparison of characteristics of MFSFET and MFISFET, the capacitor - voltage (C - V) characteristics, drain current - gate voltage (I<sub>D</sub> - V<sub>G</sub>) characteristics, and drain current ? drain voltage (I<sub>D</sub> - V<sub>D</sub>) characteristics were measured and evaluated. The memory windows of 0.1 ? 0.5 V and 0.5 ? 1.3 V for MFS and MFIS capacitors were obtained at the bias voltage of 3 V to 7 V. The on/off ratios of drain current between programmed on state and erase off state at the write voltage of 5 V were around 32 and 800 in the case of MFSFET and MFISFET, respectively. The high dielectric buffer insulator enhanced the memory window and on/off ratio of the single transistor type ferroelectric memory.