Electrical Properties of $(Bi,La)_4Ti_3O_{12}$ based ferroelectric-gated field effect transistors employed with a thermally oxidized SiO_2 layer

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Studies on the electrical properties of a metal-ferroelectric-insulator-semiconductor field effect transistor were conducted using pulsed laser deposited ferroelectric $Bi_{3.25}La_{0.75}Ti_3O_{12}$ thin films on a SiO_2/Si substrate. The 8nm SiO_2 layer was prepared on n-type Si substrates by flowing O_2 gas with purity of 3N into a high temperature furnace for 30mins at an oxidation temperature of 800□. Electrical properties from capacitance-voltage measurements showed an inversed hysteresis with relatively large memory window values of about 0.3V, 2.5V, 5.0V, and 7.0V, at increasing bias voltages of ±5V, ±7V, ±10V, and ±12V, respectively. Current-voltage measurements revealed a leakage current density calculated to be less than 10^{-8}A/cm^2 in the low electric field range. These results may be promising in yielding good endurance in retention but discussions regarding the electrical characterizations will be considered first.

Keywords: Capacitance-voltage characteristics; SiO_2; Laser ablation; $(Bi,La)_4Ti_3O_{12}$

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