Non-volatile Memory Behaviors of Al$_2$O$_3$/Cu/Al$_2$O$_3$ Multi-layers prepared by ALD

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In this study, Al$_2$O$_3$/Cu/Al$_2$O$_3$ multi-layers were fabricated using atomic layer deposition (ALD) technique on p-type Si(001) in order to investigate the floating gate memory characteristics. Al$_2$O$_3$ thin films, as control layer and tunneling layer, were grown using TMA (Al(CH$_3$)$_3$) and H$_2$O and Cu layers, as a charge-stored layer, were prepared using Cu aminoalkoxide precursor with hydrogen plasma. The films were characterized by XPS, AFM, and SEM, etc depending on the surface preparations and deposition conditions. Non-volatile memory behaviors of Al$_2$O$_3$/Cu/Al$_2$O$_3$ multi-layers were recognized by high frequency capacitance-voltage (C-V) measurements.