

Study of SrTiO₃ for Dielectric Thin Films Grown by Plasma-Enhanced Atomic Layer Deposition

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SrTiO₃ (STO) thin films as the capacitor dielectrics for the dynamic random access memory (DRAM) were deposited by plasma-enhanced atomic layer deposition (PE-ALD) method with alternating supply of reactant source, Ti(O-i-C₃H₇)₄ (TTIP) and Sr(BuCp)₂ as Ti and Sr precursors respectively. Oxygen plasma as an oxidant under different conditions. To optimize of STO films deposition, we controlled the ALD process conditions of TiO₂ films and SrO films such as substrate temperature, source dosing time, RF plasma generating power, RF plasma generating time and reactant O₂ gas flow rate. Chemical bonding state and structural properties of as-grown STO films was investigated by x-ray photoelectron spectroscopy (XPS) and X-ray diffraction (XRD). It is found that Ti anatase phase in the TiO₂ films appear at the substrate temperature above 250°C and 500 cycles, STO phase in the grown films appear at the post annealing temperature above 700°C. The electrical properties of Pt/TiO₂/TiN/Si and Pt/STO/TiN/Si structured films were also investigated by I-V, C-V measurements.

Electric Field Control of Spin-Orbit Interaction in Modulation-doped InAs Quantum Well Structure.

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The main concept of spin field effect transistor (spin-FET) is that the control of spin-orbit interaction (SOI) in a semiconductor channel manipulates spin precession. The SOI in the asymmetric potential well of the channel can be controlled by a gate electric field. Here we have carefully investigated SOI parameter (α) modulation by gate electric field (V_g) in the double-sided doped InAs channel structure (Fig. 1. left). By analysing beating patterns obtained from Shubnikov-de-Hass oscillation, we determine that α is non-linearly decreased as the increase of V_g (Fig. 1. right). From the figure, α was significantly changed at the negative V_g region, but almost saturated at the positive V_g region, indicating that the control of spin precession is insensitive in the positive V_g region. In this presentation, we will discuss evidence of the non-linear behavior on the analogy of potential well for the structure.

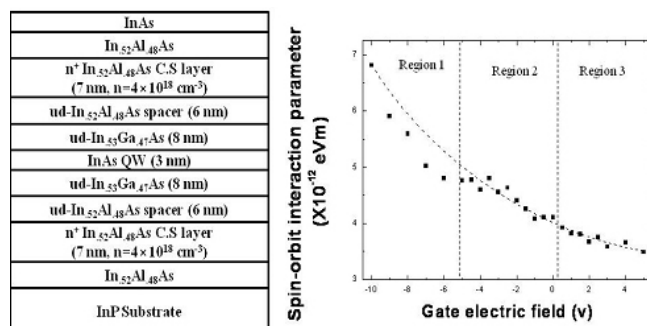


Fig. 1 A Cross-sectional view of double-sided doped InAs QW structure (left), and calculated spin-orbit interaction parameter as the external gate electric field for the structure (right).

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