A Rearch on (Ba,Sr)TiO3 Electrodes for DRAM Applications

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ABSTRACT

Abstract These thin films with different Ru/Ti compositions were first prepared by co-sputtering. The Ru/Ti ratio in the alloy was found to strongly affect the resistivity, structure formation and thermal stability. The resistivity of the as-deposited films decreases and closes to that of pure Ru metal films as the amount of Ru atoms increasing. From x-ray diffraction measurement, it was found that the RuTi phase has formed for the as-deposited sample. There also exist Ru and Ti phases for Ru-enriched and Ti-enriched samples, respectively. As-deposited alloy films were also annealed by rapid thermal processing in oxygen ambient to simulate the processing of ferroelectric/paraelectric thin film capacitors. It was found that the composition of the thin film has a large effect on the thermal stability. The resistivity of alloy thin films is thermally stable as the Ru composition varies from 0.43 to 0.81. It may be due to the RuTiO2 formation at the surface and play an important role in preventing further oxidation of the Ru-enriched layer. This oxide also presents conductive behavior. On the other hand, the interface between Ru-enriched alloys and Si substrate was still sharp for the RTP-treated sample at 600oC for 1 min. The alloy film with high Ru composition shows excellent thermal stability and barriers against interdiffusion of Si and oxygen. The characteristics of iridium oxide (IrO2) thin films deposited by r.f. reactive magnetron sputtering are studied. The deposition parameters are constant during sputtering (e.g. the r.f. power, deposition pressure) besides the oxygen partial pressure of sputtering atmosphere and substrate temperature. The effect of films deposited at different oxygen content of sputtering gas are discussed. When the films are deposited at low oxygen content , the deposited rate is higher, the resistivity is lower, the surface morphologies of films become flat. Contrarily, when the films are deposited a high oxygen content , the deposited rate decreases , the resistivity increases and the surface morphologies of thin films become rough and the adhesion is not good. Finally, the characteristics of (Ba, Sr)TiO3 deposited on the Ru-Ti alloy and Ir/IrO2 were studied.

Keywords : Bottom Electrode ; RuTi ; Iridium Oxide ; BST

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