P-005

THE EFFECT OF INSERTION OF THIN REFRACTORY METAL ON THE PERFORMANCE OF Ta BARRIER FILMS IN Cu METALLIZATION,

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We investigated the effect of insertion of thin refractory metal layers such as Zr, W, V, Nb into Ta film with/without ion bombardment on Ta diffusion barrier performance in Cu metallizaion. The insertion of thin refractory metal layer into Ta film improved the barrier properties significantly when the Ta/refractory metal/Ta barrier layers were deposited with concurrent ion bombardment. Meanwhile, thin refractory metal layer inserted Ta diffusion barrier prepared without ion bombardment produced the same results with Ta barrier without the refractory metal layer. The significant improvement of Ta diffusion barrier property by the insertion of thin refractory metal layer into Ta film with ion bombardment was attributed to the densification of grain boundaries in Ta/refractory metal/Ta films and the formation of stable amorphous intermixing layer between Ta and refractory metal layer by ion bombardment of energetic Ar ions, followed by the reduction of fast diffusion of Cu through Ta/refractory metal/Ta films

P-006

ATOMIC LAYER DEPOSITION OF Ti-Si-N THIN FILMS BY SEQUENTIAL INTRODUCTION OF $TiCl_4$, SiH_4 AND NH_3,

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Atomic layer deposition(ALD) of Ti-Si-N films between 300℃ and 500℃ has been investigated by sequential introduction of $TiCl_4$, SiH_4 and NH_3. Reactant gases were injected into the reactor in the order of $TiCl_4$ vapor pulse, Ar gas pulse, NH_3 and SiH_4 gas pulse and Ar gas pulse. Film thickness per cycle was saturated with sufficient pulse times of reactant gases. The ideal linear relationship between number of cycles and film thickness was confirmed. As a result of surface limited reactions of ALD, step coverage was excellent and surface morphology was conformal. Particles caused by the gas phase reactions of reactant gases were not observed. These films are promising for advanced diffusion barriers.

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P-007

ELECTROMIGRATION STUDY OF Al THIN FILMS DEPOSITED ON LOW DIELECTRIC POLYIMIDE AND SiO_2 ILD,

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The performance improvement of interconnection by using low dielectric materials has been widely investigated. Our research was focused on failure mechanisms of Al thin films due to electromigration on polyimides and reliability comparison of polyimide with SiO_2. Al-0.5%Cu-1%Si films were deposited by a DC magnetron sputtering system on two kinds of polyimides, BG-2480 and Pyralin-2734, and CVD SiO_2. Electromigration tests were performed in a constant voltage mode on a hot plate at 225℃ and RT. Al films deposited on SiO_2 showed much higher reliability than those on polyimides, and Pyralin-2734 showed a little higher reliability than BG-2480. The stress of Al films on polyimides changed into compressive stress during electromigration test, while that on SiO_2 did not change much. The residual stress change was due to the thermal expansion difference between polyimide and CVD SiO_2. The electromigration characteristics of Al films are affected by the residual stress and the electrical resistivity.

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P-008

EFFECT OF THE FLUORINE TREATMENT FOR THE ANTI-CORROSION OF Al(1% Cu) FILMS AFTER PLASMA ETCHING,

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Dry etching in a Cl containing plasma is a potentially important technique for patterning Al alloy lines for VLSI circuits. However Al alloy lines formed by dry etching are found to corrode upon atmospheric exposure. Especially the inclusion of Cu in aluminum to inhibit electromigration offers a more difficult plasma etching challenge. For example, the concentration of Cu may result in accelerated corrosion of aluminum in the presence of chlorine and moisture. This is not only an in-process corrosion problem but also a reliability issue for the metallization of the circuits.

In this work, the mechanisms underlying this corrosion problem have been investigated using x-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM). In the regards to the removal of AlCu corrosion, the subsequent treatment of the SF_6 or CHF_3 plasma has also been completed. This work evaluated the effects of grain boundary on the AlCu after dry etching and the role of subsequent SF_6 or CHF_3 plasma for the removal of AlCu corrosion.