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A non-destructive, fast evaluation of PVD diffusion barriers deposited on porous low-k dielectrics

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ABSTRACT

Non-destructive and fast evaluation of thin diffusion barriers deposited on top of porous low-k dielectrics by spectroscopic ellipsometry is demonstrated. Studying Physical Vapor Deposited (PVD) CoTa and CoW alloys has shown that 3 nm and 5 nm thick barriers still have holes sufficient for penetration of neutral molecules. This study also detected damage to OSG low-k films which occurs during barrier deposition. VUV light emitted by Ar plasma which is used for metal target sputtering is likely to have caused this damage. For this reason, low-k films were placed under the barriers in order to adsorb moisture during air storage. W atoms also penetrated pores of low-k film during the deposition phase.

Keywords: non-destructive evaluation; diffusion barriers; low-k; spectroscopic ellipsometry

I. INTRODUCTION

The need to reduce RC delay (R is resistance of metal conduction, C is capacitance), dynamic power consumption, and cross-talk noise requires introducing new materials to ULSI interconnects. For this reason, conventional SiO₂ inter-metal dielectrics were replaced with materials holding low dielectric constants (low-k), while Al was replaced by Cu [1]. Because of

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