The Effect of Oxygen Plasma Treatment on Methylsilesequiazane (MSZ) Material for CMP Process

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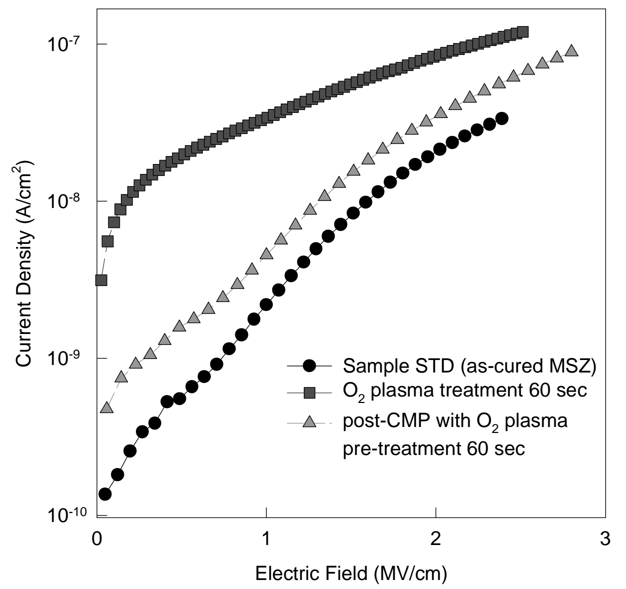
Abstract:

Since device densities are increased with the increase of functionality of a chip, multi-level-metal (MIM) interconnections are a trend for integrated circuits (ICs) fabrication. In order to construct MIM structures, the global planarization of dielectric and metal is an inevitable step for ICs manufacture. The chemical-mechanical polishing (CMP) is one accepted process for achieving the target. As part of an effort to develop the underlying principle of CMP process, the present study assessed the effect of oxygen plasma treatment on Methylsilesequiazabe (MSZ) dielectric for CMP process. In this study, the MSZ samples were prepared by spinning-on glass (SOG) process. The resulted wafers were followed by oxygen plasma treatment. After oxygen plasma treatment, the CMP process was conducted. Electrical and material analyses were utilized to estimate the characteristics of MSZ during above-mentioned process. Results showed that dielectric degradation would occur after oxygen plasma treatment. However, the electrical properties of post oxygen-treated MSZ film could be recovered after CMP process (as shown in fig1a and 1b). These results imply that one modification layer might form on surface of MSZ after oxygen plasma treatment. Furthermore, the layer would degrade the dielectric properties of MSZ films. Nevertheless, the electrical properties of MSZ film can be recovered due to the layer removed by CMP process.



(a)

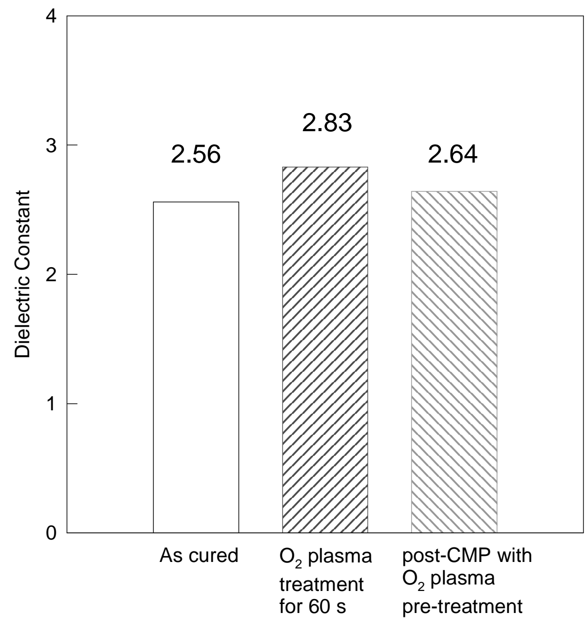


Fig. 1 electrical properties of post oxygen-treated MSZ before and after CMP process

(a) The leakage current densities as a function of electrical field

(b) The comparison of dielectric constant