Sodium Periodate 기반 Slurry의 pH 변화가 Ru CMP에 미치는 영향

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Effect of pH in Sodium Periodate based Slurry on Ru CMP

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Abstract : In MIM capacitor, poly-Si bottom electrode is replaced with metal bottom electrode. Noble metals can be used as bottom electrodes of capacitors because they have high work function and remain conductive in highly oxidizing conditions. In addition, they are chemically very stable. Among novel metals, Ru (ruthenium) has been suggested as an alternative bottom electrode due to its excellent electrical performance, including a low leakage of current and compatibility to high dielectric constant materials. Chemical mechanical planarization (CMP) process has been suggested to planarize and isolate the bottom electrode. Even though there is a great need for development of Ru CMP slurry, few studies have been carried out due to noble properties of Ru against chemicals. In the organic chemistry literature, periodate ion (IO_4^-) is a well-known oxidant. It has been reported that sodium periodate ($NaIO_4$) can form RuO_4 from hydrated ruthenic oxide ($RuO_2 \cdot nH_2O$). $NaIO_4$ exist as various species in an aqueous solution as a function of pH. Also, the removal mechanism of Ru depends on solution of pH.

In this research, the static etch rate, passivation film thickness and wettability were measured as a function of slurry pH. The electrochemical analysis was investigated as a function of pH. To evaluate the effect of pH on polishing behavior, removal rate was investigated as a function of pH by using patterned and unpatterned wafers.

Key Words : Ruthenium, CMP, Sodium Periodate, $NaIO_4$