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Hydrogen Plasma와 Oxygen Plasma를 이용한 50 nm 텅스텐 패턴의 Oxidation 및 Reduction에 관한 연구

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The oxidation characteristics of tungsten line pattern during the carbon-based mask layer removal process using oxygen plasmas and the reduction characteristics of the WO_x layer formed on the tungsten line surface using hydrogen plasmas have been investigated for sub-50 nm patterning processes. The surface oxidation of tungsten line during the mask layer removal process could be minimized by using a low temperature (300°K) plasma processing instead of a high temperature plasma processing for the removal of the carbon-based material. Using this technique, the thickness of WO_x on the tungsten line could be decreased to 25% of WO_x formed by the high temperature processing. The WO_x layer could be also completely removed at the low temperature of 300°K using a hydrogen plasma by supplying bias power to the tungsten substrate to provide an activation energy for the reduction. When this oxidation and reduction technique was applied to actual 40 nm-CD device processing, the complete removal of WO_x formed on the sidewall of tungsten line could be observed.

Keywords: Plasma Treatment, Hydrogen Plasma, Oxygen Plasma, Reduction of Metal Surface