

**Title: Development of High  
Selectivity of W to Hardmask in  
W/poly gate**

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**Abstract**

As the critical dimension of tungsten/polysilicon stack gates decreases, control of the etching process becomes increasingly difficult due to several key issues such as etch rate microloading, uniformity and selectivity. W/poly layer is the next generation gate stack due to low resistivity. However, etching of W/poly typically has a low hardmask selectivity for conventional fluorine chemistry, which makes etching hard. In this paper, a more systematic approach based on correlation between the peak-to-peak voltage and hardmask etch rate. Black tungsten, which was similar to black Si in deep trench etching, was observed near the depositive process regime. Extremely low etch rate microloading was obtained by controlling the oxygen flow rate near the depositive process. Lastly, optimization between the bias power and oxygen flow rate resulted in higher selectivity of W to poly, which was about 1.2, within this chemistry regime.