Development of a High-Density-Plasma System for Dry Etch Applications

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ABSTRACT

本論文係結合靜電式探針（Langmuir probe）的檢測技術應用，研究探討在感應耦合式高密度電漿系統中，經由腔體壓力、ICP 功率、RF功率以及氣體流量等參數的改變，量測其解離出來的電漿特性，並將所研究之結果實際應用於製程驗證上，在此研究上我們將應用於SiO2的深度蝕刻，端看電漿的特性變化調整如何使之得到最佳蝕刻效果。 於電漿研究部分，從分析結果顯示不論上述何種參數之改變，其解離出的電漿密度皆在1011 cm-3 以上的等級。尤其當ICP功率由400 W逐漸增加到1200 W時，電漿密度亦可從1.3 ×1011 cm-3上升至3.8 ×1011 cm-3；反觀其它參數之改變，整體電漿密度的變化量為1.9 ×1011到3.2 ×1011 cm-3 之間，這顯示ICP功率對於電漿密度之影響能力最強。此外由於電漿之功率密度計算為離子通量（ion Flux）與離子能量（ion Energy）的乘積值，其同時兼具離子數量與能量之特性，因此對於以物理性為主的蝕刻製程 (ion-driven etch)，尤其是在蝕刻率方面，電漿之功率具有決定性的影響，相關實驗同時也由矽石光波導之蝕刻得到驗證。

Keywords : 乾蝕刻 ; 電漿密度 ; Langmuir 探針

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