熱氧化成長氧化鉿薄膜特性之研究與探討

楊尚剛、NOTE

E-mail: 344704@mail.dyu.edu.tw

摘 要

本研究針對稀土族元素中的鉿金屬，採用熱氧化來完成鉿金屬氧化層的製備。利用E-Gun將金屬鉿(Hafnium)沉積在矽晶圓表面上，在高溫爐管中以不同的溫度(600°C~900°C）進行氧化反應，成長氧化鉿(HfO2)膜，再以LCR Meter (1MHz)高頻範圍量測氧化物薄膜之電容－電壓(C-V)特性曲線，計算出各氧化物樣本之介電常數(ε)皆大於25。由儀器HP4156C量測結果得知，當所加偏壓為-1V時，樣本的洩漏電流密度小於10-7 A/cm2且崩潰電場強度皆在9 MV/cm以上。以穿透式電子顯微鏡(TEM)量測薄膜厚度，發現不同溫度所成長的氧化物薄膜厚度不同。再以原子力顯微鏡(AFM)量測薄膜表面薄膜由巨觀角度而言，不同溫度所成長的氧化物薄膜厚度不同，薄膜表面粗糙度(Ra)亦有所差異，且氧化溫度越高，Ra值越大。其結晶結構與成長溫度有相依關係，較低溫(600°C)時，結構為四面錐體(Tetrahedron) ，當溫度逐漸提升，成長的結構漸發生改變，由四面體變為六面錐體(Hexahedron)以致於八面錐體(Octahedron)，而長晶的方向是由底部(基材的表面)往上成核再逐漸堆疊成錐體，各錐體尖端經Nanoscope III輾平操作後，所呈現的圖案有相同之處。

關鍵詞 : 氧化鉿、穿透式電子顯微鏡(TEM)、原子力顯微鏡(AFM)、粗糙度(Ra)

目錄

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