電漿處理對於矽奈米線場發射特性之效應

詹凱傑、李世鴻

E-mail: 9806490@mail.dyu.edu.tw

摘 要

本研究在(100)矽基板上蒸鍍一層鎳薄膜，在溫度(1000 ° C)、氬氣流量70sccm、成長時間2小時的狀況下誘發析出矽原子以成長矽奈米線(silicon nanowires, SiNW)。本研究針對SiNW電漿處理過後，電流與電場間的關係來進行研究。從SEM圖中發現，在電漿處理過程中SiNW會逐漸稀疏，導致SiNW的發射點變多。EDS的元素分析發現到，經過電漿處理後，氧元素比例會逐漸下降，而矽元素比例相對有提升。典型SiNW的場發射電流比奈米碳管來得小，但是經過H2電漿處理後，SiNW的屏蔽效應會被有效地降低，使得電子容易從尖端射出。而經過CF4電漿處理的SiNW會產生叢集的現象，因而提高SiNW的表面密度，增加其場發射點。CF4+H2電漿處理的SiNW的屏蔽效應會被有效地降低且表面密度提高，增加其場發射點。SiNW經過電漿後處理可以大幅改善其場發射特性，獲得足以與奈米碳管相比擬的場發射特性。這顯示SiNW具有作為場發射元件的發展潛力。

關鍵詞 : 矽奈米線、場發射、電漿、屏蔽效應

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