摻雜鋁氧化鋅奈米柱與p型矽異質接面之電性

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摘 要

本研究使用水溶液法在p型矽基板上製備摻雜鋁氧化鋅(aluminum-doped zinc oxide, Al-doped ZnO)奈米柱並量測不同摻雜硝酸鋁(aluminum nitrate, Al(NO3)3．9H2O)濃度之摻雜鋁氧化鋅之表面型態、結構成分與導電性。實驗中，先以無水酒精(ethyl alcohol, C2H5OH) 加入醋酸亞鋅(zinc acetate, Zn(CH3COO)2．2H2O) 調製成0.0075M之溶液，以旋轉塗佈(spin coating)方式於p型矽基板製備種子層(seeding layer)。之後，再以體積濃度0.02M的四氮六甲圜(hexamethylenetetramine, C6H12N4)、0.02M的硝酸鋅(zinc nitrate hexahydrate, Zn(NO3)2．6H2O)及不同濃度硝酸鋁調製成混和溶液，加熱至90?C並維持兩小時以成長氧化鋅奈米柱。由場發式電子顯微鏡(field-emission scanning electron microscopy, FE-SEM)觀測到氧化鋅為六角柱狀，並且由能量質譜儀(energy diffraction spectroscopy, EDS)分析得知摻雜鋁氧化鋅奈米柱是由鋅、氧及鋁所組成並且摻雜硝酸鋁濃度越多，鋁原子所佔的比例也越高。由霍爾效應(Hall effect)量測證實摻雜鋁氧化鋅奈米柱的確具有n型導電性，並且導電率有因摻雜而上升趨勢，而隨著硝酸鋁濃度愈高，多數載子濃度隨之上升，多數載子遷移率則會下降。另外，實驗也發現摻雜鋁氧化鋅奈米柱之光激發螢光(photoluminescence, PL)峰值大約在376.1nm至379.4nm之間。最後，我們在p型矽基板成長摻雜硝酸鋁氧化鋅奈米柱以構成n-ZnO/p-Si異質接面，此n-ZnO/p-Si異質接面展現整流特性，我們量測此異質接面之電流—電壓特性，並成功決定其逆向飽和電流密度、理想因子等特性參數。

關鍵詞 : 摻雜鋁氧化鋅、霍爾效應量測、光激發螢光

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