第五章　結　論

本實驗利用電鍍法將低熔點元素(Zn)填入至氧化鋁陽極膜模板內，製得鋅金屬奈米線材，並經 400 ℃的氧氣氣氛爐氧化後，獲得氧化鋅的陣列奈米線;以 XRD、SEM 和 TEM 儀器觀察鋅奈米線和氧化鋅奈米線陣列的結構和表面型態和光激發光能譜儀量測各種不同直徑氧化鋅之發光特性，其分析結果歸納如下:

1. 鋅離子藉由毛細現象(capillary effect)附著在 AAO 模板上，讓氧化鋅奈米線可在高深寬比的氧化鋁管中得以成核和成長，但由於孔壁上的缺陷，造成像:雙晶、疊差和低角度晶界都可能會產生不同結晶方向的成長。

2. 以電鍍法製備鋅奈米線/商用 AAO，在 2.0 V、3 分鐘時，鋅奈米線最佳長度為 33 μm；以草酸 AAO 為模板時，在 2.0 V 、3 分鐘時，鋅奈米線最佳長度為 10 μm；以硫酸 AAO 為模板時，在 1.5 V 、3 分鐘時，鋅奈米線最佳長度為 3 μm。鋅奈米線在孔徑越小時其成長速率越快達到平緩，是由於高深寬比和電鍍速率太快，導致孔洞被堵塞，讓氧化鋅長度受到抑制。

3. 氧化鋅是六角實心柱，繞射圖形為 HCP 結構(繞射面為(102)、(101))，但因為繞射點有暈開現象，又加上 XRD 分析的結果，也證實

為氧化鋅奈米線為多晶(poly crystalline)的 wurtzite 結構。

4. 在氧化鋅/商用 AAO 的 PL 分析中，其發光波長分成兩大部分，分別是紫光波長(386 nm)和綠光波長(491 nm)。綠光波長顯示出氧空位的存在，而紫光波長則是形成氧化鋅完美結晶結構所造成的結果。

5. 氧化鋅/草酸 AAO 的 PL 分析，紫光波長 382 nm 的強度較弱，大部分是偏向綠光波長 497 nm，顯示著草酸的氧化鋅奈米線仍含有相當多的氧空位。

6. 氧化鋅/硫酸 AAO 的 PL 分析，除了有較強的紫光波長外(378 nm)，並且呈現出藍光波長(450 nm)，顯示在奈米尺寸下，經熱處理步驟的氧化鋅奈米線可趨近於完美結晶的結構。

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