

生醫用多孔鈦合金支架之製作與表面改質研究

賴宗瑄、何文福、劉大銘

E-mail: 321894@mail.dyu.edu.tw

摘要

近幾年來多孔金屬的開發對於金屬植入材而言可謂具有相當性地突破，而本試驗以極具生物活性及低彈性模數的鈦鉬合金系統為出發藍圖並利用成孔劑脫除法製作多孔鈦鉬支架；因為碳酸氫氨(NH₄HCO₃)具有低熔點的特性在脫除上較為簡易，所以選擇它為成孔劑。而實驗初期嘗試以球磨(ball milling)方式使鈦與鉬元素粉末達至均質，球磨至t₉時候由背向式電子(backscattered electrons, BSE)顯微觀察發現，粉末呈現一均質型態，故以此組粉末進行多孔鈦鉬支架的製作，但結果顯示其抗壓強度極為脆弱，原因乃在大氣環境下球磨之鈦金屬粉末其氧化程度高達45 wt%，進而導致其燒結性不佳，故後續本試驗將以無球磨之鈦與鉬元素粉末以元素混合(blended elemental)方式進行多孔支架的製作。本試驗以不同的成孔劑添加量製作多孔支架，分別為40、50、60、70及80 vol%，然而隨著孔隙率的增加其抗壓強度也隨之下降，然而成孔劑添加量為60 vol%的多孔鈦鉬支架其抗壓強度與彈性模數為分別為127 MPa及4.21 GPa，綜合以上結果是適合於皮質骨植入材的應用，而此組條件亦選為後續表面改質之應用。為了探討孔洞對磷灰石生成的影響故以無孔鈦鉬為一對照組。在一開始的表面改質(鹼及鹼水處理)後發現試片表面將形成一網狀多孔結構，經高解析X光繞射(high resolution X-ray diffractometer, HR-XRD)分析顯示為Na₂Ti₆O₁₃鈦酸鈉水凝膠層(sodium titanate hydrogel)，後續人工模擬體液(simulated body fluid, SBF)浸泡結果顯示鹼及鹼水處理後之多孔鈦鉬於SBF浸泡14天後發現孔洞內部已長滿磷灰石，但鹼處理條件下其磷灰石為大顆；直至21天時，孔洞內外皆以佈滿磷灰石，但實心部分仍無明顯結果，而且在無前處理條件下之多孔鈦鉬支架在浸泡21天後也無任何磷灰石生成。

關鍵詞：粉末冶金、多孔鈦金屬、機械性質、表面改質、人工模擬體液

目錄

目錄 封面內頁 簽名頁 授權書.....	iii
iv 英文摘要.....	vi
vii 目錄.....	ix
xiv 表目錄.....	xvii
第一章 序論.....	
1.1 研究背景.....	1.1.2 研究目的.....
3 第二章 簡介及文獻回顧.....	5.2.1 鈦及鈦合金簡介.....
5.2.2 金屬生醫植入材的機械性質需求.....	6.2.2.1 骨質溶解(osteolysis).....
6.2.2.2 力遮蔽效應(stress-shielding effect).....	6.2.3 生物相容性.....
7.2.4 粉末冶金的發展.....	8.2.5 粉末冶金的優勢與缺失.....
11.2.5.1 粉末冶金的優勢.....	11.2.5.2 粉末冶金的缺失.....
12.2.6 粉末的類型.....	13.2.6.1 預合金型 (pre-Alloyed).....
13.2.6.2 快速固溶型 (rapid solidified).....	13.2.6.3 元素混合型 (blended elemental).....
13.2.7 機械合金法.....	14.2.8 壓製生胚之粉末變形行為.....
15.2.9 生胚的燒結.....	17.2.10 鈦基粉末冶金發展.....
19.2.11 添加元素對鈦燒結影響.....	19.2.12 粉末的混合.....
20.2.13 改善鈦基粉末燒結之碳化問題.....	21.2.14 脫脂行為(debinding behavior).....
22.2.14.1 熱脫脂.....	22.2.14.2 溶劑脫脂.....
23.2.14.3 真空脫脂.....	24.2.14.4 觸媒脫脂.....
25.2.15 脂造成的缺陷與成因.....	25.2.15.1 胚體破裂.....
25.2.15.2 胚體變形.....	26.2.15.3 胚體起泡與脫皮.....
26.2.16 織工程支架的發展.....	26 第三章 基礎理論.....
29.3.1 機械合金化的影響參數.....	29.3.1.1 球磨裝置.....
29.3.1.2 球磨速度.....	29.3.1.3 球磨時間.....
30.3.1.4 球磨介質.....	30.3.1.5 球磨比.....
30.3.1.6 充填率.....	31.3.1.7 氣體環境.....
31.3.1.8 過程控制劑.....	31.3.1.9 球磨溫度.....
32.3.2 支架的製作.....	32.3.3 成孔劑脫除法.....
46.3.4 影響參數.....	46.3.4.1 成孔劑的形狀.....
46.3.4.2 成孔劑的尺寸.....	46.3.4.3 生胚壓力.....
47.3.4.4 燒節環境.....	47.3.5 表面改

質.....	49	第四章 球磨對鈦鉬元素粉末的性質影響.....	
...51 4.1 前言.....	51	4.2 材料與實驗方法.....	
...51 4.2.1 實驗流程.....	51	4.2.2 機械合金化粉末的製備.....	53
分析.....	55	4.2.3 粉末XRD相.....	
.....55 4.2.4 粉末表面型態觀察.....	55	4.2.5 粉末元素分析.....	
.....55 4.2.6 混粉與造粒.....	56	4.2.7 壓製生胚.....	58
結.....	60	4.2.8 生胚燒.....	
.....62 4.2.9 SEM觀察.....	61	4.2.10 EDS元素分析.....	
.....62 4.2.11 抗壓測試.....	62	4.3 結果與討論.....	
... 63 4.3.1 原始粉末之SEM顯微觀察.....	63	4.3.2 球磨粉末電子顯微觀察.....	65
氧與碳含量變化.....	67	4.3.3 球磨粉末的.....	
.....71 4.3.4 球磨粉末背向式電子顯微觀察.....	68	4.3.5 粉末XRD分析.....	
.....71 4.3.6 多孔鈦鉬合金燒結.....	75	4.3.7 EDS元素分析.....	75
電子顯微觀察.....	75	4.3.8 背向式.....	
.....75 4.3.9 機械性質之測試.....	78	第五章 多孔鈦鉬支架之機械性質的.....	
提升與 表面改質分析.....	80	5.1 前言.....	
.....80 5.2 材料及實驗方法.....	80	5.2.1 實驗流程.....	80
5.2.2 微結構分析.....	85	5.2.2 機械性質測試.....	86
.....88 5.3 結果與討論.....	92	5.3.1 微結構觀察與分析.....	
.....92 5.3.2 機械性質分析.....	100	5.3.3 前處理.....	103
.....114 第六章 結論.....	118	5.3.4 SBF.....	
.....120		浸泡.....	
		

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