牙科用鑄造鈦錫合金之結構及性質研究

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摘 要

本研究中，進?探討一系?二元Ti-xSn合?之微結構、機械性質、研削性及切削性，並以商業用純鈦(Grade II)作為對照組，期望能開發出適合作為牙科應用之鈦合金。實驗結果顯示，Ti-xSn合?之繞射峰完全與純鈦(Grade II) α繞射峰相符，且無發現β相或任何的鋒?。Ti-xSn合?的微硬度值因Sn元素含量增加而提升，由246 HV(TS-A)至357 HV(TS-E)，TS-E合?顯示擁有最高的微硬度值。Ti-xSn合?之彎曲強度、彈性模數及彈性回復角均比c.p. Ti高。例如，TS-A合?之彎曲強度高於c.p. Ti約68 %，而彈性模數量高於c.p. Ti約43 %，其彈性回復角高於c.p. Ti約240 %。此外，TS-A、TS-B及TS-C合?展現出韌性性質，當Sn元素添加至TS-D或是更高時，合金之機械性質也會由韌性轉為脆性。

評估研削性為金屬每分鐘的移除量(研削量)及金屬被研削之切屑體積與砂輪直徑被磨削之體積的比(研削比)，而每個金屬之研削性都依賴著這些條件。當Sn元素添加入c.p. Ti發現，在Sn元素含量較高時，使其更加容易加工，有助於改善研削性質。在1200 m/min 研削速率下，TS-D合金之研削速率是c.p. Ti的2.8倍。此外，TS-C、TS-D及TS-E合金於1200 m/min 研削速率下，分別高於c.p. Ti約1.8、1.7、2.4倍。

切削性的評估為切削進給長度，測試時間固定3分鐘，由刀具從試片邊緣切削進給，計算不同合金之平均切削進給長度。實驗結果顯示，以目前的切削條件下，Ti-xSn合?與c.p. Ti相比，當Sn元素含量遞增時，使其切削進給長度有大幅提升的趨勢。在Sn元素含量較高時，展現出更加容易之加工特性。TS-D合金於120 m/min 切削轉速下，砝碼重為200 gf及300 gf時，切削長度各別為c.p. Ti約1.3、1.4倍；此外，TS-E合金於同樣之切削條件下，切削長度各別為c.p. Ti約1.7、1.8倍。而TS-D及TS-E合金於120 m/min 切削轉速下之試片凹槽表面，顯示出沒有金屬切屑的黏附，且擁有最低的表面粗糙值(Ra)。

關鍵詞 : 牙科合?、鈦錫合金、微結構、機械性質、研削性、切削性

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