

STUDY ON ADHESION STRENGTH OF TIN COATED BIOMEDICAL Ti-13Zr-13Nb ALLOY

A. Shah^{a*}, S. Izman^b, Siti Nurul Fasehah Ismail^c, Mas-Ayu H.^d, R. Daud^d

^aFaculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia

^bFaculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

^cFaculty of Biosciences and Medical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

^dFaculty of Mechanical Engineering, Universiti Malaysia Pahang, 26300 Pekan, Pahang, Malaysia

Article history

Received

20 March 2017

Received in revised form

29 August 2017

Accepted

10 January 2018

*Corresponding author
armanshah@ftv.upsi.edu.my

Abstract

One of the crucial factors which determine the success of coated implantation and stability in the long run is the strength of adhesion between the coating and substrate. After implantation, a weakly adhered coating may delaminate and this might seriously restrict the implant's effectiveness and longevity. Based on past studies, the quality of TiN coating is directly influenced by the process parameters. The objective of this research is to evaluate the effect of N₂ gas flow rate on adhesion strength of biomedical grade Ti-13Zr-13Nb alloy. In this research, N₂ gas flow rate of 100, 200 and 300 sccm were varied while the other parameters (substrate temperature and bias voltage) were fixed. The scratch testing method was used to examine the adhesion strength of the TiN coating. This research used the calibrated optical images to verify the total coating failures on the scratched coated samples. The results indicated that the micro droplet form on the TiN coating decreases as the flow rate of the N₂ gas increases. In contrast, the TiN coating's adhesion strength increases with the increase of N₂ gas flow rate. It can be concluded that N₂ gas flow rate was significant factor in improving the coating properties of TiN on Ti-13Zr-13Nb alloy.

Keywords: Biomaterial, Ti-13Zr-13Nb, adhesion strength, TiN and CAPVD

Abstrak

Salah satu faktor yang penting dalam menentukan kejayaan salutan implan dan kestabilan untuk jangka masa panjang ialah kekuatan lekatan antara salutan dan substrat. Selepas proses implantasi, lekatan salutan yang lemah mungkin akan tertanggal dan ini akan memendekkan jangka hayat dan keberkesanan implan. Berdasarkan kajian lepas, kualiti salutan titanium nitrida secara langsung akan dipengaruhi oleh proses parameter. Objektif kajian ini ialah untuk menilai keberkesanan kadar aliran gas N₂ ke atas kekuatan lekatan gred bio-perubatan aloi Ti-13Zr-13Nb. Dalam kajian ini, kadar aliran gas nitrogen 100, 200 dan 300 sccm telah diubah manakala suhu substrat dan voltage bias telah dikekalkan. Ujian cakaran telah digunakan untuk menilai kekuatan salutan TiN. Selanjutnya, kajian ini menggunakan imej-imej optik ditentukur untuk mengesahkan jumlah kegagalan lapisan pada sampel bersalut yang dicakar. Keputusan kajian menunjukkan bahawa titisan mikro daripada lapisan TiN berkurang apabila kadar aliran gas N₂ bertambah. Sebaliknya, kekuatan lekatan salutan TiN akan bertambah dengan bertambahnya kadar aliran gas N₂.

Kata kunci: Biomaterial, Ti-13Zr-13Nb, kekuatan lekatan, TiN and CAPVD

© 2018 Penerbit UTM Press. All rights reserved