A STUDY ON PREPARATION OF MAN-MADE HIPBONE BY USING COMPOSITE POROUS TITANIUM

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ABSTRACT

A porous layer of 2mm thick on the end surface of man-made composite hipbone was coated with TC4 spherical titanium alloy powder prepared by plasma rotating electrode process in present study. The present work emphasised the influences of particle size, sintering process and the roughness of matrix surface on the pore size of composite porous layer, porosity and the bonding strength between porous layer and matrix. The mechanical properties of composite porous man-made hipbone were also tested. Experimental results show that the maximum pore size of materials depends mainly on particle size and increases linearly with increase of particle size. The key factors influencing bonding strength include sintering process, particle size and the roughness of matrix surface. Bonding strength enhances with increase of sintering temperature and its holding time, decrease of particle size and the increase in the roughness of matrix surface. Porosity depends only on the piled up condition of powder. The mechanical properties obtained from the preparation of man-made hipbone by using composite porous titanium: $\sigma_b = 830-880$MPa, $\sigma_{0.2} = 810-840$MPa, $\delta = 9.5-12.0\%$, $\psi = 26.0-33.0\%$.

INTRODUCTION

In recent years, artificial joints are widely used in the clinic. According to incomplete statistics, several million people had been provided with artificial joints and other implants in the world. For example, 2 million metal implants are used every year in U.S.A, among them, 50 thousand hip implants are used[1]. With scientific technical developments and medical treatments improving, more and more metal implants will be used in the medical field.

But with the metal implants used in the clinic now there exist some looseness problems. For example, the loosening of the prosthesis caused in the displacement of man's skeletal joints will cause the operation to fail. Apart from the infection of the displacement site, the other main reason for prosthesis loosening lies in the joining methods. At present, there are three methods of joining the prosthesis: to impact the prosthesis stem into the medullary cavity of the bone; to join mechanically by using screws and nuts; or to connect by means of bone cement. But the fixed prosthesis will be come loose after long term use. This will cause necrosis of the bone, and will cause a terrific pain to patients. To find a new method of fixating metal implants, we carried out research into the femoral head with composite porous titanium. Its characteristic is that the bone tissue can directly grow into the pore of the composite porous layer so as to get a firm fixing