

In vitro and in vivo biocompatibility evaluation of Zr-Ti-Si and Fe-Zr-Nb thin film metallic glasses

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1. Abstract

Thin film metallic glass (TFMG) has been considered in the biomedical applications due to its better corrosion resistance, which attracts lots of attention from academic and industry. In this study, a co-deposition system consisting of a high power impulse magnetron sputtering (HiPIMS) and a radio frequency (RF) power supply was used to prepare Zr-Ti-Si and Fe-Zr-Nb TFMGs on the surface of 316 L stainless steel specimen [1-3].

The chemical composition, microstructure and surface roughness of Zr-Ti-Si, Fe-Zr-Nb TFMGs were analyzed by a FE-EPMA, FE-SEM and AFM respectively. The nanoindentation, scratch test and HRC-DB adhesion test were employed to evaluate the mechanical and adhesion properties of TFMGs. The corrosion resistance of TFMGs in 3.5 wt. % NaCl aqueous solution was conducted by a potentiodynamic polarization test. The MG-63 cell line (human osteosarcoma) was used to investigate the biocompatibility of coatings. Finally, the animal tests were executed to examine any allergy, poisoning or carcinogenic reaction was brought by the TFMGs to the rats.

Through the in-vitro cell test and in-vivo animal tests, both Zr-Ti-Si and Fe-Zr-Nb TFMGs exhibited better biocompatibility because of their good corrosion resistance, good hydrophilic properties and improved adhesion on the 316L

surface. We can conclude that Zr-Ti-Si and Fe-Zr-Nb TFMGs have very excellent potential application in the biomedical field.

2. Acknowledgments

The authors gratefully acknowledge the financial support of the Ministry of Science and Technology, Taiwan through contract nos. MOST 106-2218-E-131-003, MOST 105-2218-E-131-001, MOST 107-2221-E-182-021 and MOST 107-2221-E-131-002 -MY3. The financial support from the Chung Gung Memorial Hospital through contract no. BMRP280 to B.S. Lou is also acknowledged.

3. References

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