

论文

脉冲电沉积制备HA/ZrO₂纳米复合涂层的稳定性及生物相容性评价

王英波, 鲁雄, 冯波, 屈树新, 翁杰

西南交通大学材料科学与工程学院, 材料先进技术教育部重点实验室, 成都 610031

摘要:

采用脉冲电化学沉积法成功地在生物医用钛金属表面制备出均匀的纳米HA/ZrO₂复合涂层. 通过热处理提高涂层的致密性, 同时保留涂层的微纳结构. 考察了热处理后复合涂层的成分、形貌、生物相容性及生理稳定性. X射线衍射分析表明, 复合涂层成分为HA和ZrO₂. 扫描电镜观察发现, 热处理后复合涂层的致密性有所提高. 研究发现, ZrO₂的加入大大降低了HA/ZrO₂复合涂层中钙离子的释放速度, 提高了HA/ZrO₂复合涂层的生理稳定性. 纳米划痕实验结果表明, HA/ZrO₂复合涂层具有较好的结合强度. 通过培养成骨细胞考察了复合涂层的生物相容性. Alamar Blue检测表明, HA/ZrO₂复合涂层表面细胞黏附及增殖能力较好. ALP检测发现, 热处理后HA/ZrO₂复合涂层表面的细胞分化能力较强. 综合细胞培养结果显示, HA/ZrO₂复合涂层有较好的生物相容性.

关键词: HA/ZrO₂复合涂层; 脉冲电化学沉积; 稳定性; 生物相容性

Investigation of the Stability and Biocompatibility of HA/ZrO₂ Nanocomposite Coatings Prepared by Pulsed Electrochemical Deposition

WANG Ying-Bo, LU Xiong*, FENG Bo, QU Shu-Xin, WENG Jie

Key Laboratory of Advanced Technologies of Materials, Ministry of Education, School of Materials Science and Engineering, Southwest Jiaotong University, Chengdu 610031, China

Abstract:

The dense and uniform HA/ZrO₂ composite coatings were fabricated on titanium substrates by pulsed electrochemical deposition. The composition, morphologies, biocompatibility and physiological stability of the composite coatings were studied. X-ray diffraction showed Ca₈(PO₄)₄(HPO₄)₂·5H₂O in the coating was converted into hydroxylapatite(HA) and the coating was composed of HA and ZrO₂ after heat treatments. Scanning electron microscopy(SEM) indicated that ZrO₂ was uniformly distributed in the coatings and the coatings became dense after heat treatments. Atomic absorption spectrometry analysis was used to measure Ca²⁺ release rate of the coatings immersed in PBS. It was found that the Ca²⁺ release rate of HA/ZrO₂ was lower than that of pure HA coatings. Nanoscratching testing revealed that HA/ZrO₂ coatings had better interfacial bonding strength than that of pure HA coatings. Osteoblasts were cultured on the coatings to evaluated the biocompatibility of coatings. The results of the Alamar Blue and ALP test indicated that the composite coatings could favor the proliferation and differentiation of the osteoblasts. In summary, the as-prepared nanocomposite coatings have good biocompatibility.

Keywords: HA/ZrO₂ composite coating; Pulsed electrochemical deposition; Stability; Biocompatibility

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通讯作者: 鲁雄, 男, 博士, 副教授, 主要从事生物材料方面的研究. E-mail: luxiong_2004@163.com

作者简介:

参考文献:

[1]WANG Xiu-Hong(王秀红), DUAN Ke(段可), FENG Bo(冯波), et al.. Chem. J. Chinese Universities(高等学校化学学报)[J], 2009, 30(6): 1071—1074

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- [2]XIAO Xiu-Feng(肖秀峰), LIU Rong-Fang(刘榕芳), ZHENG Yang-Zeng(郑炆曾). Rare Metal Mat. Eng.(稀有金属材料与工程)[J], 2005, 34: 1798—1801
- [3]Evis Z., Usta M., Kutbay I.. J. Eur. Ceram. Soc.[J], 2008, 29: 621—628
- [4]Balamurugan A., Balossier G., Kannan S., et al.. Ceram. Int.[J], 2007, 33: 605—614
- [5]Gu Y. W., Khor K. A., Pan D., et al.. Biomaterials[J], 2004, 25: 3177—3185
- [6]Li H., Khor K. A., Kumar R., et al.. Surf. Coat. Technol.[J], 2004, 182: 227—236
- [7]Balamurugan A., Balossier G., Kannan S., et al.. Ceramics International[J], 2007, 33: 605—614
- [8]Xiao X. F., Liu R. F., Zheng Y. Z.. J. Mater. Sci.[J], 2006, 41: 3417—3424
- [9]WANG Zhou-Cheng(王周成), HUANG Long-Men(黄龙门), TANG Yi(唐毅), et al.. Acta Phys. Chim. Sin.(物理化学学报)[J], 2006, 22: 590—595
- [10]WANG Ying-Bo(王英波), LU Xiong(鲁雄), ZHAO Jing(赵婧), et al.. Rare Metal Mat. Eng.(稀有金属材料与工程)[J], 2008
- [11]Lu X., Leng Y.. Biomaterials[J], 2005, 26: 1097—1108
- [12]Engin K., Leeper D. B., Cater J. R.. Int. J. Hyperther.[J], 1995, 11: 211—216
- [13]Lee E. S., Kun N., Bae Y. H.. J. Controlled Release[J], 2003, 91: 103—113
- [14]Huang L., Xu K., Lu J., et al.. Diamond Relat. Mater.[J], 2001, 10: 1448—1456
- [15]QIAN Jie(钱捷), YANG Ce-Yao(杨策尧), SHENG Xun(盛迅). J. Clin. Stomatol.(临床口腔医学杂志)[J], 2005, 21: 384—350
- [16]WANG Shen-Guo(王身国). Chin. J. Rehabil. Theory Practice(中国康复理论与实践)[J], 2002, 5: 267—269

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