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低Ca/P比溶液电沉积羟基磷灰石涂层

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摘要: 电沉积羟基磷灰石涂层具有工艺简单、过程易控制、适于在复杂表面制备厚度均匀涂层的特点。沉积液Ca/P比(原子数分数)直接影响涂层中的物相组成与涂层形貌。作者采用电沉积与后续热处理相结合的工艺,用低Ca/P比溶液在金属钛表面沉积羟基磷灰石(HA)涂层。利用X射线衍射、透射电镜和扫描电镜分析了涂层中物相组成及后续热处理对涂层中物相和涂层形貌的影响。实验结果表明:电压与电解液温度等工艺参数影响涂层中羟基磷灰石的含量以及沉积过程中晶体长大和形核方式。随电压与温度的升高,涂层中羟基磷灰石含量增加。在低温、高压下,电沉积过程以晶体长大为主,涂层薄而致密;在高温、低压下,电沉积过程以晶体形核为主,涂层厚而疏松。经500℃空气中热处理后,涂层基本转化为羟基磷灰石,其Ca/P比约为1.61。电沉积涂层由片状和条状物质组成;热处理后,形貌基本未改变,但颗粒因失水发生团聚。通过精确控制电压与电解液温度等参数,能获得内层致密外层疏松的理想梯度结构HA涂层材料,满足对生物植入体的多种要求。

关键字: 羟基磷灰石;电沉积;生物涂层;生物梯度材料

Preparation of HA coating in low Ca/P ratio solution by electro deposition

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Abstract: The electro deposition process and heat treatment are used to fabricate hydroxyapatite biocoating on the surface of Ti-based material in low Ca/P ratio solution. XRD, SEM and TEM are used to analyze the phase composition, and the effect of treatment on the phase composition and the morphology of the coating. The results show that: the parameters affect the content of HA and the style of the growth and the formation of the crystals. The content of HA in the coating increases with the voltage and the temperature increasing. With the high voltage and the low temperature, the crystals grow chiefly; with the low voltage and the high temperature the formation of the crystals is principal. After heat treatment 500°C, the phase composition of coating is almost HA in which the Ca/P ratio is 1.61; the coating is composed of plate-like and strip-like particles that are not changed and aggregated after heat treatment. Through controlling the parameters precisely, the HA coatings with biologically gradient structure can be obtained to satisfy the requirement of biomaterial.

Key words: hydroxyapatite; electro deposition; biocoating; biologically gradient materials

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