

EFFECT OF REACTION TIME FOR FORMATION OF CALCIUM PHOSPHATE COATING ON MAGNESIUM ALLOY ON ITS CORROSION BEHAVIOR IN SIMULATED BODY FLUID

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ABSTRACT

Magnesium (Mg) alloy was immersed in an aqueous solution supersaturated against hydroxyapatite at the moderate temperature and pressure. After the immersion in the solution, the whole surface of the Mg alloy was coated with plate-like crystals consisted of octacalcium phosphate (OCP). Then the OCP-coated Mg alloy was ultrasonically washed and removed fragile OCP. We found that the remained OCP layer improved the corrosion resistance of the Mg alloy in simulated body fluid and the optimum reaction time in the formation of OCP coating existed to improve the corrosion behavior.

Keywords: Magnesium alloy, Octaclcium phosphate coating, Aqueous solution method, Corrosion resistance

INTRODUCTION

Magnesium (Mg) alloy has higher tensile strength than conventional polymeric biomaterials and the lower elastic modulus in comparison with conventional metallic biomaterials such as titanium alloys. Special properties of the Mg alloys is to corrode in body environment because standard electrode potential of Mg is lower than that of titanium. Furthermore, Mg is one of the typical essential elements in biological systems. In spite of these advantages, Mg alloys have a clinical problem in orthopaedic application that their corrosion speed is too fast to maintain the necessary strength until the affected part is completely cured.

Many kinds of surface modification techniques to control the corrosion rate of Mg alloy in body environment were studied. Among them, formation of calcium phosphate coating has been actively studied because calcium phosphate coatings provide osteoconductivity to materials. It has been reported that crystalline hydroxyapatite or octacalcium phosphate (OCP) coatings improved the corrosion resistance of Mg alloys in body environment [2]. There are many methods to coat Mg and its alloys with crystalline calcium phosphate such as plasma spraying method [3], sol-gel method [4], electrodeposition method [5], and electrophoretic deposition method [6], and so on. In particular, aqueous solution method has several advantages such as shape selectivity, low energy cost, and economical reasons. However, it is difficult to coat Mg alloys with crystalline calcium phosphate in a short time in an aqueous solution in general because Mg^{2+} inhibits the crystallization of calcium phosphate [7].

In the previous study, we succeeded in formation of crystalline calcium phosphate coating on Mg alloy by using supersaturated solution of hydroxyapatite under the normal temperature (36.5 ℃) within 1 day [8]. In this study, we tried to coat Mg alloy with the crystalline calcium phosphate layer with different reaction time and evaluated the effect on Mg corrosion in simulated body fluid (SBF) [9].

ISBN: 987-1-7752455-7-5