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Photo-Controlled Corrosion Performance on AZ31 Magnesium Alloy by Photoacid Generator(PAG)/ Poly (lactic-co-glycolic) Acid (PLGA) Coating

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Introduction: As a good biodegradable medical alloy material, magnesium alloy has been widely used in orthopedic surgery. However to prevent the too fast corrosion of magnesium alloy is still the key to expand the application of magnesium alloy. So it is urgent and important to control the corrosion performance of magnesium alloy. We designed a coating system controlled by light-stimuli rather than other stimulating signals[1,2] that accelerates the rate of corrosion behavior. The smart coating is synthesized by photoacid generator (PAG)[3]/Poly (lactic-co-glycolic) acid (PLGA)[4]. The PAG plays an intelligent adjustable factor in this system.

Materials and Methods: The morphologies of the treated AZ31 magnesium alloys were determined by scanning electron microscopy (SEM, JSM6510LV) equipped with energy-dispersive spectroscopy (EDS). The chemical states of the film was further detected by X-ray photoelectron spectroscopy (XPS, Thermo Fisher Scientific Escalab 250Xi) with Al Kα irradiation. A simple device for collecting hydrogen is used to observe the corrosion rate of samples. The CHI660E electrochemical analyzer was used to test the electrochemical performance of samples, and the tests results and corrosion mechanism were fitted by the software Zsimpwin 3.21.

Results and Discussion: The results demonstrated that the outerlayer of PLGA was tightly and evenly distributed on the surface, providing a good anti-corrosive effect at early stage. The photoacid generator directly contacted with the surface of magnesium alloy. When exposed to the visible light, the test groups's rate of hydrogen production was accelerated than the dark groups, which implied the corrosion accelerated. When light was moved, the amount of produced hydrogen is almost the same as that of the dark groups.

Conclusion: In summary, we have successfully synthesized photoacid generator(PAG)/polymer coating. By controlling different concentration of initial photoacid generators, the rate of corrosion can be adjusted. This work can provide new ideas and methods for magnesium alloy as biomedical and biodegradable material in terms of the design of smart regulation on material degradation and future metal corrosion performance.

References:

[1] C. D. Ding, Y. Liu, M. D. Wang, T. Wang, J. J. Fu, Self-healing, superhydrophobic coating based on mechanized silica nanoparticles for reliable protection of magnesium alloy, J. Mater. Chem. A, 21 (2016) 8041-8052.

[2] Y. Zhao, R. Berger, K. Landfester, D. Crespy, Double redox-responsive release of encoded and encapsulated molecules from patchy nanocapsules, Small, 11 (2015) 2995-2999.

[3] H. Oh, A.X. Lu, V. Javvaji, D.L. DeVoe, S.R. Raghavan, Light-directed self-assembly of robust alginate gels at precise locations in microfluidic channels, ACS. Appl. Mater. Inter. 8 (2016) 17529-17538.

[4] W. Zhang, Y. Chen, M. Chen, S. Zhao, J. Mao, A. Qu, W. Li, Y. Zhao, N. Huang, G. Wan, Strengthened corrosion control of poly (lactic acid) (PLA) and poly (ε-caprolactone) (PCL) polymer-coated magnesium by imbedded hydrophobic stearic acid (SA) thin layer, Corros. Sci. 112 (2016) 327-337.

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