Pengendalian laju korosi paduan biodegradabel magnesium az31 dengan perlakuan anodizing dan coating = Control of corrosion rate biodegradable magnesium az31 alloy with anodizing and coating treatments

Muhammad Dikdik Gumelar, author

Abstrak

Magnesium Mg dan paduannya terdegradasi secara spontan dalam lingkungan fisiologis melalui peristiwa korosi sehingga berpotensi digunakan sebagai material implan biodegradabel. Namun diperlukan pengendalian laju degradasinya yang masih dianggap terlalu tinggi dalam tubuh manusia. Cara paling efektif dalam mengendalikan laju korosi bahan adalah dengan penambahan lapisan penghalang barrier di permukaan. Pada penelitian ini pengendalian korosi dilakukan dengan teknik anodizing untuk menghasilkan lapisan anodik oksida penghalang dan diuji coba pada paduan komersil AZ31. Untuk meningkatkan efisiensi lapisan oksida, dilakukan proses final coating dengan beeswax-colophony resin dengan tujuan menutup pori lapisan anodik oksida. Proses anodizing dilakukan pada tegangan konstan 5 volt dalam elektrolit 0.5 M Na3PO4 pada suhu 30 C 1 C dengan variasi waktu 2, 5, dan 10 menit. Pada waktu 2 menit belum terdeteksi lapisan, sedangkan pada 5 dan 10 menit terukur tebal lapisan 5 dan 11 ? m. Optimasi komposisi campuran beeswax-colophony menghasilkan rasio optimum 60:40, yang selanjutnya digunakan untuk proses final coating. Kinerja lapisan anodizing dan coating diuji dengan metode elektrokimia yaitu potentiodynamic polarization dan electrochemical impedance spectroscopy EIS . Hasil uji elektrokimia divalidasi dengan uji hilang berat secara invitro selama 14 hari dalam larutan ringer laktat pada suhu 37 C. Hasil uji korosi pada paduan AZ31 menunjukkan peningkatan ketahanan korosi bertahap yang diperlihatkan oleh kenaikan potensial korosi berturut-turut: -1.44, -1.42, -1.32, dan -1.19 VAg/AgCl dan penurunan arus korosi 9.11, 5.02, 1.92, 0.18 ? A/cm2 pada kurva polarisasi substrat; setelah coating; setelah anodizing; dan setelah anodizing dan coating. Kecenderungan yang sama diperoleh dari hasil uji hilang berat yang menunjukkan penurunan laju korosi berjenjang dari substrat, setelah coating; setelah anodizing; setelah anodizing dan coating berturut-turut yaitu 1.09, 0.49, 0.13, dan 0.01 mmpy. Hasil tersebut menunjukkan bahwa perlakuan anodizing dan coating terbukti dapat meningkatkan ketahanan korosi paduan AZ31 secara drastis sebesar 100 kali.

.....Magnesium Mg and its alloys are spontaneously degraded in physiological environments through corrosion events therefore potentially used as biodegradable implant materials. But it is necessary to control the degradation rate of Mg alloys that is still considered too high in the human body. The most effective way of controlling the corrosion rate of materials is by the addition of a barrier layer on their surfaces. In this study, corrosion control was performed by anodizing technique to produce anodic oxide barrier layer on AZ31 Mg alloy. To improve the coating efficiency, a final coating with beeswax colophony resin was conducted with the purpose to seal the pore in the anodic oxide layer. The anodizing process was carried out at a constant voltage 5 V in 0.5 M Na3PO4 electrolyte at 30 C 1 C with time variations of 2, 5, and 10 min. Within 2 minutes the layer has not been detected, while at 5 and 10 minutes the thicknesses were 5 and 11 m. Optimization of beeswax colophony mixture composition gives optimum ratio of 60 40, which is then used for final coating process. The anodizing and coating performance was tested and by electrochemical

methods of potentiodynamic polarization and electrochemical impedance spectroscopy EIS and invitro weight loss method for 14 days, in lactated ringer solution at 37 C. The results of electrochemical test were validated by weight loss method. The corrosion test results in AZ31 alloys showed an increase in gradual corrosion resistance shown by the incremental corrosion potential increase 1.44, 1.42, 1.32, and 1.19 VAg AgCl and decreased corrosion currents 9.11, 5.02, 1.92, 0.18 A cm2 on the substrate polarization curve after coating after anodizing and after anodizing and coating. The same trend is obtained from the weight loss test results indicating a decrease in the tiered corrosion rate of the substrate, after coating after anodizing after anodizing and coating respectively are 1.09, 0.49, 0.13, and 0.01 mmpy. These results show that anodizing and coating treatment has been shown to significantly increase the corrosion resistance of AZ31 alloys by 100 times.