ABSTRAK

PERAMBATAN RETAK FATIK *CRITICAL TIP OPENING DISPLACEMENT* (CTOD) PADA MAGNESIUM AZ31B DALAM LARUTAN *RINGER LAKTAT*

Oleh
Maherariyat

Penelitian ini bertujuan untuk mengevaluasi mekanisme korosi serta pengaruh waktu perendaman terhadap laju korosi dan perilaku perambatan retak fatik paduan magnesium AZ31B dalam larutan *ringer laktat*. Pengujian laju korosi dilakukan menggunakan metode kehilangan berat (*weight loss*) berdasarkan standar ASTM G31 dengan variasi waktu perendaman hingga empat minggu. Analisis morfologi dan produk korosi dilakukan menggunakan *Scanning Electron Microscope–Energy Dispersive Spectroscopy* (SEM–EDS) serta *X-Ray Diffraction* (XRD). Pengujian perambatan retak fatik dilakukan berdasarkan standar ASTM E647 dengan kondisi material awal (raw material) serta material yang telah mengalami korosi selama satu dan dua minggu. Hasil penelitian menunjukkan bahwa laju korosi magnesium AZ31B meningkat seiring bertambahnya waktu perendaman, dengan peningkatan kehilangan massa hingga 52,9% setelah empat minggu. Analisis SEM–EDS mengindikasikan terbentuknya mekanisme korosi seragam, korosi transgranular, serta produk korosi utama berupa $Mg(OH)_2$, MgO, dan $CaCO_3$. Hasil pengujian fatik menunjukkan bahwa korosi mempercepat laju perambatan retak dan menurunkan umur fatik, yang ditandai dengan peningkatan eksponen Paris serta kegagalan lebih dini pada spesimen terkorosi. Temuan ini menunjukkan bahwa interaksi antara lingkungan korosif dan beban siklik berperan signifikan dalam degradasi mekanik paduan magnesium AZ31B, sehingga perlu menjadi pertimbangan utama dalam aplikasi biomaterial implan.

Kata kunci : Mg AZ31B, korosi, *ringer laktat*, perambatan retak fatik, biomaterial.

ABSTRACT

FATIGUE CRACK PROPAGATION BEHAVIOR AND CRITICAL TIP OPENING DISPLACEMENT (CTOD) OF AZ31B MAGNESIUM ALLOY IN RINGER'S LACTATE SOLUTION

By
Maherariyat

This study investigates the corrosion mechanisms and the effect of immersion time on the corrosion rate and fatigue crack propagation behavior of AZ31B magnesium alloy in Ringer's lactate solution. Corrosion rate measurements were carried out using the weight loss method in accordance with ASTM G31, with immersion periods of up to four weeks. Surface morphology and corrosion products were characterized using Scanning Electron Microscopy coupled with Energy Dispersive Spectroscopy (SEM–EDS) and X-ray Diffraction (XRD). Fatigue crack propagation tests were conducted in accordance with ASTM E647 on raw material specimens as well as specimens pre-corroded for one and two weeks. The results show that the corrosion rate of the AZ31B magnesium alloy increases with increasing immersion time, with mass loss rising by up to 52.9% after four weeks. SEM–EDS analysis revealed the occurrence of uniform corrosion and transgranular corrosion, along with the formation of dominant corrosion products such as $Mg(OH)_2$, MgO, and $CaCO_3$. Furthermore, the fatigue test results indicate that corrosion significantly accelerates crack propagation and reduces fatigue life, as reflected by higher Paris law exponents and earlier failure in corroded specimens. These findings demonstrate that the combined effects of corrosive environments and cyclic loading play a critical role in the mechanical degradation of AZ31B magnesium alloy and should be carefully considered in biomedical implant applications.

Keywords: **Mg AZ31B,** ***corrosion, corrosion, Ringer's lactate, fatigue crack propagation, biomaterials***