Two main goals have been followed in the current study: firstly, microstructural and functional modification of PEO coating by incorporation of multi-walled carbon nanotubes (MWCNTs) and polycaprolactone (PCL) duplex treatment, secondly, design and fabrication of a system to simulate in vivo condition for under evaluated Mg alloy specimens. SEM, FESEM and Raman spectra confirmed successful incorporation of MWCNTs into the microstructure of PEO coating. Furthermore, microstructural modifications such as thickening of inner barrier layer up to ٢?m, increase in porosity level up to two times and increase in portion of crystallic phase were evident due to presence of MWCNTs. Wear and bio-tribocorrosion results showed reduction of coefficient of friction and wear-related damages of the PEO coating by up to ٪٦٠ due to MWCNTs incorporation. However, there were not meaningful difference between short term (٣٠ minutes) and midterm (٤٨ hours) impedance corrosion current density values, but the polarization curves demonstrated significant difference in pitting potential of MWCNTs-containing and MWCNTs-free PEO coatings. Comparison of the collected hydrogen after ١٥ days immersion in quasi-in vivo conditions revealed that MWCNTs-containing and MWCNTs-free PEO coatings has reduced hydrogen generation by ٪٩٠ and ٪٧٠, respectively. Furthermore, the specimen covered by MWCNTs-containing PEO coating and ٦٠?m thick polycaprolactone (PCL) layer exhibited the lowest hydrogen generation volume (٠٫٢ mL.cm٢) compared to the other under evaluated specimens. MWCNTS-reinforced PEO coaing increased quasi-in vivo corrosion-fatigue performance of ZX٠٠ Mg alloy by up to three times. Furthermore, ZX٠٠ Mg alloy with MWCNTs-reinforced PEO/thick PCL coating showed the highest quasi-in vivo corrosion fatigue life among
the under evaluated specimens

Keywords: Magnesium alloy, Biodegradable implant, Wear, Quasi-in vivo conditions, Plasma electrolytic oxidation (PEO), Multi-walled carbon nanotubes (MWCNTs), Polycaprolactone (PCL), Corrosion resistance, Biotribocorrosion