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EFFECT OF ALD-APPLIED AL_2O_3 COATING ON ELECTROCHEMICAL PROPERTIES OF WE43 MAGNESIUM ALLOY FOR BIOMEDICAL APPLICATIONS

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Magnesium alloys have a similar Young's modulus to human bone, making them a biomaterial suitable for use as orthopaedic implants. In addition, magnesium alloys have the ability to biodegrade in the tissue environment, which translates into not having to perform the reoperation associated with the removal of an implant. However, magnesium alloys show poor corrosion resistance in body fluid environments and are subject to too rapid degradation. Implants made of biodegradable magnesium alloys should retain their functionality until full bone fusion at the fracture site. In addition, excessive hydrogen release during the degradation process remains an unresolved problem, which can result in negative reactions of the implant to the surrounding tissues. In order to ensure controlled biodegradation various surface modifications are used, including protective coatings to increase corrosion resistance.

The aim of this study was to evaluate the electrochemical properties of a surface-modified magnesium alloy WE43 intended for medical applications. The surface of the analysed biomaterial was modified by mechanical polishing and the deposition of an Al_2O_3 layer by low-temperature atomic layer deposition (ALD). The samples were then placed in simulated body fluid for 4 and 8 weeks, respectively. The following tests were carried out to evaluate the electrochemical properties of the modified WE43 alloy: potentiodynamic test, electrochemical impedance spectroscopy and hydrogen evolution measurement.