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Enhanced corrosion resistance and biocompatibility of magnesium alloys by plasma-based techniques

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Abstract: Biodegradable magnesium (Mg) alloys have attracted much attention in recent years due to their potential applications to temporary orthopedic implants. However, the attractive biomedical applications of Mg alloys are hampered by the rapid degradation rate in the physiological environment. Plasma-based techniques such as ion implantation and magnetron sputtering are widely used to tailor the biomaterials surface to obtain the desirable functions. Hence, they are applied to incorporate metal (neodymium, hafnium, tantalum, and niobium) oxide/nitride into the surface layer of Mg-based alloys to improve the anticorrosive and biocompatible properties. The corrosion behavior are systematically studied by polarization curves, electrochemical impedance spectroscopy, and immersion tests. The cell adhesion and proliferation are also determined to evaluate the biological response in vitro. Our results show that significant improvement in both the corrosion resistance and cell attachment, spreading, and proliferation in vitro are observed as a result of the oxide/nitride surface layer on the Mg alloys. Hence, plasma-based techniques provide effective and practical strategies to enhance the corrosion resistance and biocompatibility of Mg-based biomedical implants.

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