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The effect of electro-pulsing induced gradient topographic oxide coating of Ti-Al-V alloy strips on the fibroblast adhesion and growth

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The effects of electro-pulsing induced gradient topographic oxide coating of Ti-Al-V alloy matrix strips on the fibroblast adhesion and growth were investigated. The goal in biomaterial surface modification was to possess desired recognition and specificity through modifying its surface condition like topological structure. Here we developed a unique strategy of high-energy electro-pulsing treatment (EPT) for manipulating surface gradient bio-functionalization of basal textured Ti-6Al-4V alloy strips with the surface gradient topographic oxide coating, which brings in the gradient distribution of surface conditions including matrix alloy, ordinary TiO2 film and TiO2 microwaves on a single strip. High-energy electro-pulse is frequently used as an electrically-treated method in improving the materials microstructure and mechanical property. This paper reports firstly the surface modification under EPT aiming to improve the biocompatibility, which will meet the demand of biomaterials in different parts of human beings. Novel TiO2 microwaves topological structure on the materials surface resulted in better biocompatibility with more active fibroblast bio-reaction including higher cells viability, better physiological morphology and stronger adhesion binding, which is ascribed to surface chemical components, surface energy and specific surface area under EPT manipulation. The key role in forming TiO2 microwaves structure solely under EPT is the selective effect of the electro-pulses going through the textured specimen, which thus builds a selective growth of the oxide and forms the microwaves topological structure on the materials surface. The positive contributions of EPT in the thermodynamics and kinetics of oxide coatings growth are attributed to the reduction of nucleation energy barrier and acceleration of atomic diffusion. Thus, the gradient functionalization of biomaterials can be tuned over several seconds EPT in the titanium alloys, opening an energy-saving and high-efficiency door to diverse biomedical applications including the tissue engineering and biological interfaces.

Biography

Xiaoxin Ye is from the Department of Materials Science and Engineering, Tsinghua University, China. His research fields involve the biomedical titanium alloy processing/characterization, surface modification, mechanical/corrosion/biocompatibility property. His research is currently about electropulsing-assisted processing and characterization of titanium alloy. Electro pulsing ultrasonic striking and electropulsing-induced topographical oxidation have been also brought in to modify the materials surface for improving the microhardness, corrosion resistance and biocompatibility. His research interests include green materials processing, surface coating, nanomaterials, energy materials and biomaterials.

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