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Development of nanostructured photocatalytic coatings for anti-bioadhesion and self-cleaning of residual bacterial cells

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ABSTRACT

In this work, nanostructured oxide coatings with photocatalytic activity were prepared by anodization, Zn acetate (ZnAc) modification and/or annealing, enabling high-performance anti-bioadhesion and self-cleaning of residual bacterial cells and biofilm upon sunlight irradiation and/or H₂O₂ treatment. The morphology, surface roughness, composition and semiconducting properties of the nano-coatings were characterized by atomic force microscopy, Raman spectroscopy and ultraviolet (UV)-visible diffuse reflectance spectroscopy. The anti-adhesion of the coatings to *P. aeruginosa* bacteria was measured by a confocal laser scanning microscope, and their electrochemical stability was evaluated by open-circuit potential and linear polarization resistance measurements in a chloride solution. The results demonstrate that, compared to the prepared anodized, annealed and 1-time ZnAc modified nano-coatings, the 2-time ZnAc modified nano-coating containing photocatalytic ZnFe₂O₄ achieves the best anti-bioadhesion performance and self-cleaning of residual bacterial cells and biofilm, while maintaining a high electrochemical stability. The nano-coating achieves 99.6% of anti-bioadhesion under sunlight irradiation relative to bare steel. The treatment of 1 h UV irradiation and 0.02 mM H₂O₂ allows

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