

Nanocolumnar coatings on implants exhibiting antibacterial properties

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Addressing the problem of infection from the very first stage, i.e. inhibiting the formation of the bacterial biofilm, is a crucial step to prevent implant rejection. Nanocolumnar coatings exhibiting antibacterial properties have been fabricated by oblique deposition with magnetron sputtering [1]. The formation of nanocolumns (Fig.1) is the result of the effects of atomic shadowing when the atoms reach the surface along an inclined direction [2]. This technique is environmentally friendly: it is carried out at RT and does not involve chemical products (no recycling problems). Such methodology have been tested in a semi-industrial scale reactor, successfully coating in a single step the two sides of fixation plates for bone fractures [3]. Several in vitro experiments have been performed: analysis of bacterial adhesion and biofilm formation, analysis of osteoblast proliferation and mitochondrial activity, and osteoblasts–bacteria competitive growth scenarios, the latter also named “Race for the Surface” competition. In all these cases, the coatings show an opposite behavior toward osteoblast and bacterial proliferation [1,3]. Moreover, they are effective against Gram positive (*S. aureus*) and Gram negative (*E. coli*) bacteria [4]. Finally, when a synergic route is followed and the coatings are functionalized with Te nanorods, the antibacterial properties are enhanced, since Te adds contact-killing (Fig. 2), i.e. bactericidal effect, whilst the biocompatibility is preserved [4].

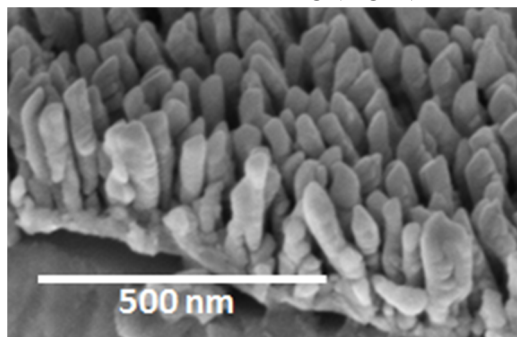


Fig. 1: Side view SEM image of Ti nanocolumns.

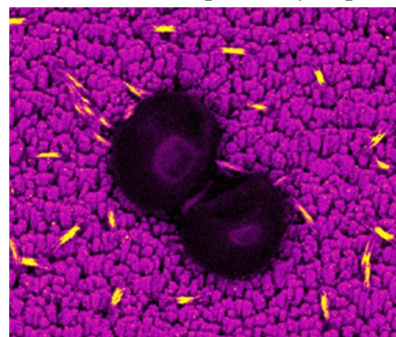


Fig. 2: Top view SEM image of two *S.aureus* (in black) on top of Ti nanocolumns (in violet) in contact with Te rods (yellow).

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References

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