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Antibacterial surface modification of Ti based material for implants

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Statement of the Problem: Titanium and its alloys are widely used as implant material due to their tensile strength, flexibility, corrosion resistance, high hemo- and biocompatibility. A defined surface nanotopology offers guidance of the implant vs. cell interaction and at the same time gives opportunities for further modifications; promoting the bone growth, providing nano-containers for antibacterial agents, etc.

Methodology & Theoretical Orientation: Different strategies are applied to modify titanium and titanium alloy implant material, aiming at better antibacterial properties and biocompatibility. Pure titanium and titanium alloy Ti7Al are anodized to create titanium nanotubes. Subsequently, the nanotubes are annealed in order to transform the obtained TiO_2 into TiO_2 anatase phase (XRD and Raman spectroscopy). In a following step, the surface is electrochemically modified.

Findings: It is shown that addition of phosphate to the ethylene glycol based bath has certain influence on the titanium nanotubes topology. Nanotubes (pTNT) with a diameter of 100 nm are produced in ethylene glycol containing fluoride and phosphate, as additives. By electrochemical deposition the pTNT are uniformly filled with Se and coated with Cu_2Se or Ag_2Se . The composition and the structure of the layers are confirmed by EDX, FIB, SEM and XRD. A positive effect of Se on the nucleation of hydroxyapatite (HAp) during the electrodeposition was established. The quality and adhesion of the HAp coating is found to strongly depend on the structure of the substrate, the pH value of the bath, the applied voltage and the temperature.

Conclusion & Significance: Uniform and circular pTNT with a diameter of 100 nm are produced and regularly filled with antibacterial agent. A bone like substance HAp with nano-crystalline structure is successfully electrodeposited on the pTNT surface. The as-prepared coatings will be further examined in medical *in-vitro* and *in-vivo* experiments and undergo clinical tests.

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Biography

Jie Sun is a PhD student at the Technical University of Vienna working at the Institute of Chemical Technologies and Analytics. He obtained Master of Science degree in Chemistry. His research focuses on electrochemical surface modification of medical implants based on titanium.

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