

Stimulation of Hydroxyapatite Precipitation on Ion Beam Modified Ti Surfaces

Problem:

Hydroxyapatite (HA) coatings are used to stimulate the bonding between the bone tissue and an implant. Problems with the HA coating are in the limited adherence to the substrate and insufficient control of composition and crystal structure. Increasingly HA precipitation out of a simulated body fluid has been favoured. This requires a significant increase of nucleation points for HA on the Ti surface.

Objective:

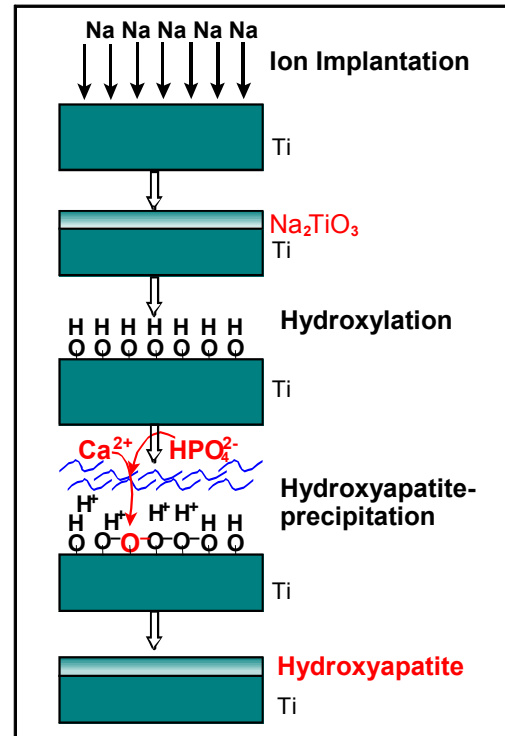
Induction of nucleation points on the Ti surface for HA precipitation under biological conditions.

Proposed Solution:

Generation of hydroxylated Ti surfaces via sodium titanate (Na_2TiO_3):

- Step 1: Na-Ion Implantation (Fig 1)
- Step 2: Hydroxylation
- Step 3: HA-Precipitation (Fig 2 and 3)

Prozess:



Results:

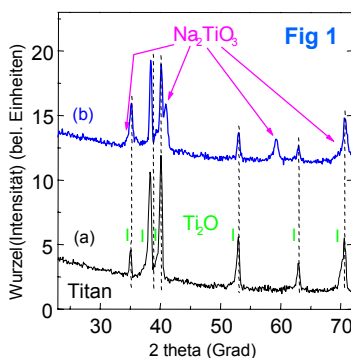


Fig 1: X ray diffraction

Prove of Na titanate formation after Na implantation: Na^+ , 50 keV, $2 \times 10^{17} \text{cm}^{-2}$ (b) compared with an untreated Ti reference (a)

The implantation results in an up to 50 times increased hydroxylation by Na_2TiO_3 -Hydrolysis (37° , 4h) [determined via the H-content by NRA: $^1\text{H}(^{15}\text{N}, \alpha, \gamma)^{12}\text{C}$].

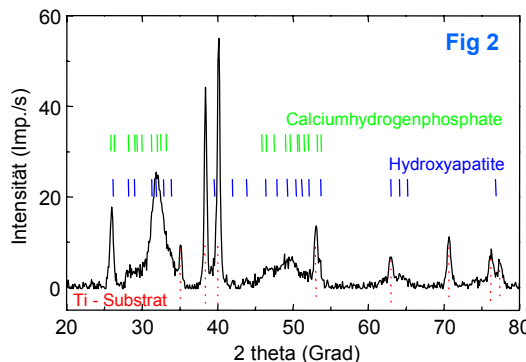


Fig 2/3:

Enhanced hydroxyapatite formation on an ion implanted Ti surface (Fig 3, top) compared with an non implanted Ti surface (Fig 3, bottom) after incubation in simulated body fluid. The precipitated were identified as hydroxyapatite by X ray diffraction.

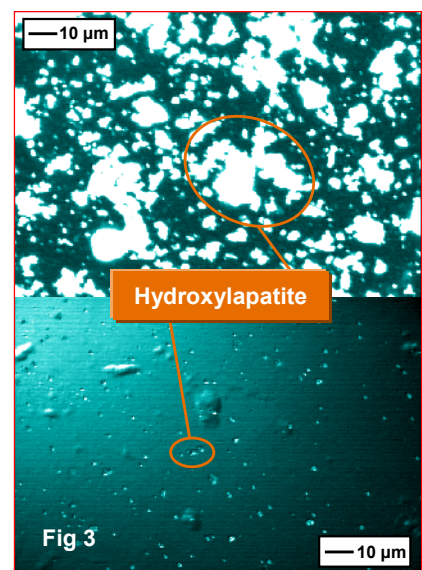


Fig 3