Ultrasound-driven titanium modification with formation of titania based nanofoam surfaces

Abstract

Titanium has been widely used as biomaterial for various medical applications because of its mechanical strength and inertness. This on the other hand makes it difficult to structure it. Nanostructuring can improve its performance for advanced applications such as implantation and lab-on-chip systems. In this study we show that a titania nanofoam on titanium can be formed under high intensity ultrasound (HIUS) treatment in alkaline solution. The physicochemical properties and morphology of the titania nanofoam are investigated in order to find optimal preparation conditions for producing surfaces with high wettability for cell culture studies and drug delivery applications. AFM and contact angle measurements reveal, that surface roughness and wettability of the surfaces depend nonmonotonously on ultrasound intensity and duration of treatment, indicating a competition between HIUS induced roughening and smoothening mechanisms. We finally demonstrate that superhydrophilic bio-and cytocompatible surfaces can be fabricated with short time ultrasonic treatment.

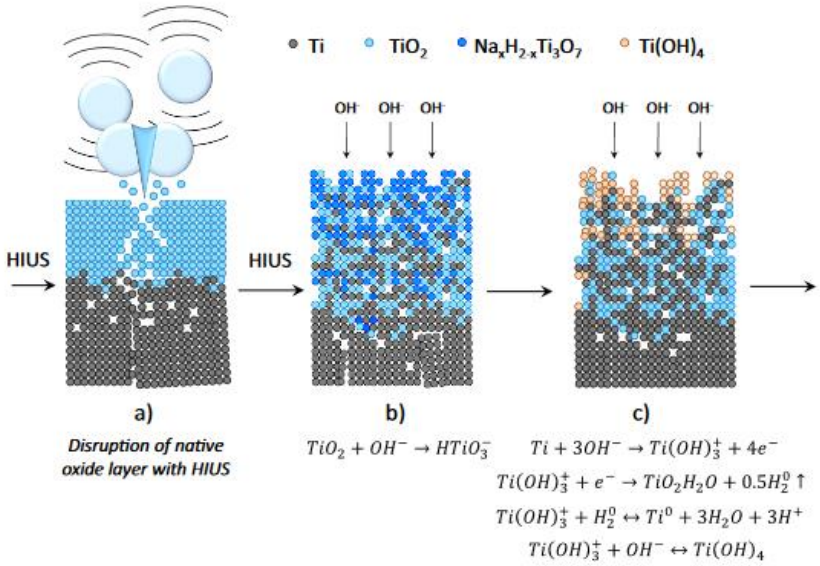

Fig. 3. Schematic illustration of the structuring process taking place during the HIUS treatment of a titanium surface in aqueous solution of NaOH.