Title: Wetting behaviour of femtosecond laser textured Ti-6Al-4V surfaces

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Abstract: The aim of the present work was to investigate the wetting behaviour of biomedical grade Ti-6Al-4V alloy surfaces textured by a femtosecond laser treatment. The material was treated in ambient atmosphere using an Yb: KYW chirped-pulse-regenerative amplification laser with a wavelength of 1030 nm and a pulse duration of 500 fs. Four main types of surface textures were obtained depending on the processing parameters and laser treatment method. These textures consist of: (1) nanoscale laser-induced periodic surface structures (LIPSS); (2) nanopillars; (3) a bimodal roughness distribution texture formed of LIPSS overlapping microcolumns; (4) a complex texture formed of LIPSS overlapping microcolumns with a periodic variation of the columns size in the laser scanning direction. The wettability of the surfaces was evaluated by the sessile drop method using distilled-deionized (DD) water and Hank's balanced salt solution (HBSS) as testing liquids. The laser treated surfaces present a hydrophilic behaviour as well as a high affinity for the saline solution, with equilibrium contact angles in the ranges 24.1-76.2. for DD water and 8.4-61.8. for HBSS. The wetting behaviour is anisotropic, reflecting the anisotropy of the surface textures.

Author Keywords: Wetting behaviour; Femtosecond lasers; Surface texturing; Surface anisotropy; Ti-6Al-4V implants
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