Ultrasonically Produced Porous Sponge Layer on Titanium to Guide Cell Behavior

Abstract

The adhesion of cells to surfaces, as well as their proliferation, migration, and differentiation, is guided not only by chemical functionalization but also by surface nanostructuring, nanotopography.Nano-patterned titanium surfaces are one example in which the scale of patterning controls the size of focal adhesions. Nanoscale disorder in surface structure can be used to stimulate cell differentiation or can also be used to maintain stem cell phenotypes over long times. Nanoroughness modulates cells interactions and function via mechanosensing. These all suggest that the careful control of surface nanostructure of such important as titanium (Ti) biomaterial could be a useful tool to achieve desired cellular responses.

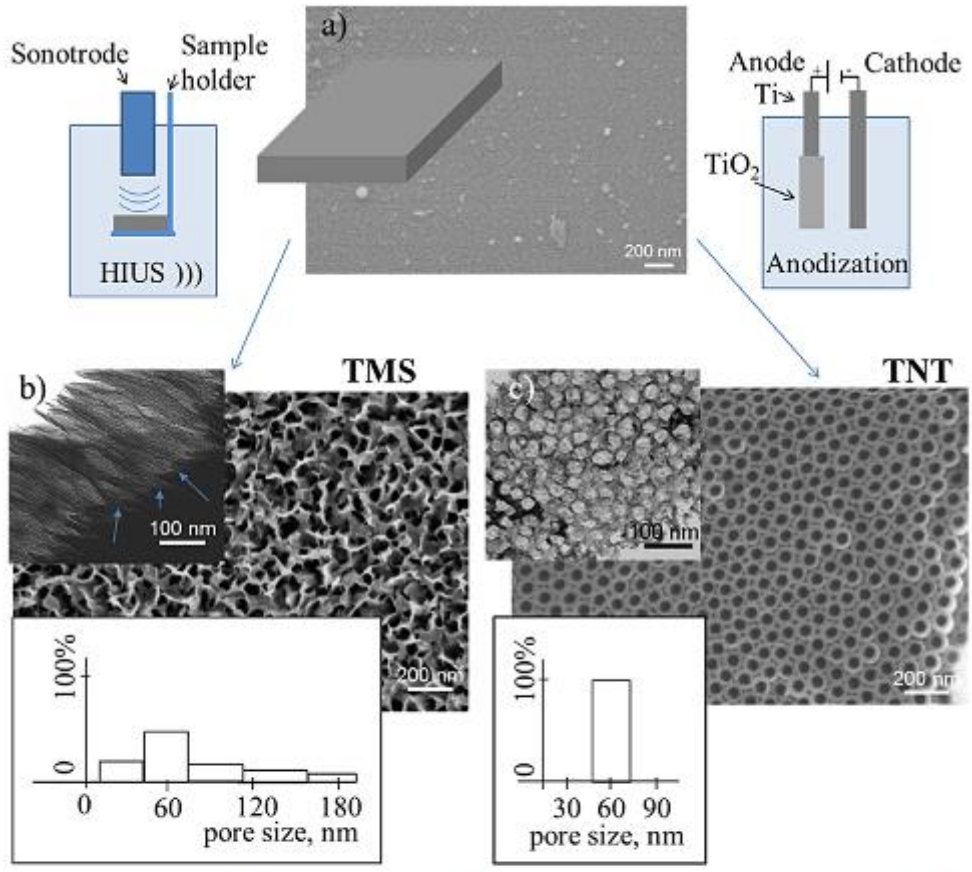

Fig. 1. Schematic view of the two techniques used for titanium surface nanostructuring for following nanotopography-guided cell behavior and a view of the corresponding resulting surfaces formed by modification of initial flat titanium surface (shown in (a)); SEM of the sonochemically formed under high-intensity ultrasonic treatment (HIUS) titania mesoporous sponge layer (TMS) (b) and anodized titania nanotubes layer (TNT) (c). Insets (b, c) are TEM (slice-microtome) images of a cross-section through the TMS interface, side view (b), through the TNT, top view, and histograms of pore size distribution on TMS and TNT.